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ORIGINAL MEMOIRS.

THE ANATOMY AND SURGERY OF THE INTERNAL DERANGEMENTS OF THE KNEE-JOINT.

BASED ON A STUDY OF 150 DISSECTED JOINTS AND THE LITERATURE.

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ANATOMY.

THE knee is a joint depending entirely upon ligaments for its strength. Disregarding the patella, there are only two small articular areas in contact in all positions of the limb. These areas are convex on the femoral side, and slightly concave, plain, or even convex on the tibial side. There is neither cup nor socket nor real concavity of any sort, though there is a short and shallow mortise-and-tenon effect produced by the projection of the tibial spines into the popliteal notch. The two bones with the articular cartilage left on and all the ligaments removed are in unstable equilibrium in all positions. This mechanical disadvantage and the arrangement of the lubricating apparatus which is at times inadequate, and at times an actual obstacle to the working of the joint, furnish the chief reasons why the knee is the most frequently deranged of all the joints in the human body.

The fresh articular surfaces differ somewhat in shape from the ends of the dried bones. The articular cartilage of the femur is thickest over the trochlear surface on which the patella slides. It is also thickened along the curve of the condyles over the area which has contact with the tibia, and from this thicker strip it thins out gradually towards the margins of the bone. This makes the trochlear groove appear shallower and the condylar surfaces rounder on the fresh than on dry specimens.

The articular surface of the external tibial tuberosity is distinctly convex from before backward, and shows but little concavity from the tip of its spine to its margins. The articular surface of the internal tuberosity is slightly concave in all diameters, but by no means corresponding to the convexity of the femoral condyle. Moreover its surface is not in a horizontal plane, but slopes decidedly from before backward, giving the internal femoral condyle a constant tendency to slip backward. The articular cartilage on the upper surface of the tibia is thickest for contact with the femur, and regularly thins out from this area in all directions. Except on the surfaces which face the interspinous space, both tibial spines are covered with articular cartilage clear to their tips. Braune and Fischer have demonstrated that the shape of these surfaces changes somewhat under pressure.

Of the ligaments which hold these two joint surfaces in contact in almost all positions of the limb, some things of interest have been noted beyond the usual text-book statements.

The anterior crucial has a smaller cross-section at its middle than at either end and appears to be weaker than the posterior crucial. In twenty-three joints out of forty noted it was joined towards its upper end by a very slender bundle of fibres from the anterior end of the external semilunar,* and in six joints a small slip from the anterior crucial split off to join and be inserted with the posterior crucial.

* This differs from the experience of Testut and Mouret.

PLATE I.



Bones of right knee in extension, front view. Ligaments all removed. Position adjusted by comparison with a partially dissected joint.

PLATE II.



Bones of right knee in extension, back view.

PLATE III.



Bones of right knee flexed to 90°, front view.

PLATE IV.



Bones of right knee flexed to 90°, back view.

PLATE V.



Right knee, joint extended, front view. Lateral ligaments removed, crucials and semilunars showing.

PLATE VI.



Same as Plate V, back view.

PLATE VII.



Same as Plate V, but flexed to 90°, front view.

The posterior crucial at its insertion on the femur is joined almost always—thirty-six times in forty—by a good-sized band from the external semilunar, which is more tense in extension than in flexion.

Between the two crucial ligaments where they cross and are continually rubbing, a bursa may be found which does not usually communicate with the general synovial cavity.

These ligaments are adjusted to limit extension,[1] to control the movements of the femur and tibia in the anteroposterior plane, to carry some of the weight when the leg is swinging clear of the ground, and possibly to assist in producing close contact of the joint surfaces in internal rotation.

The semilunar fibrocartilages may be considered as the semicircular remains of complete inter-articular fibrocartilage discs with the centres worn through, leaving sharp free edges directed towards the tibial spines, and a thick periphery still attached to the inside of the capsule.

Three specimens of the 150 joints examined showed external semilunars complete, except for a small opening against the tibial spine. The internal varies in width, but so far as known has never been found as a reasonably complete disc. Both are firmly blended at their peripheries with the capsule, fibres passing into them from above and from below. Both lose their layer of cartilage at their extremities, become fibrous bands, and blend with the tibial periosteum or become continuous with some ligament.

The external semilunar in front is mainly attached to the non-articular surface of the external tibial spine. Its peripheral attachment to the capsule is interrupted by the opening for the popliteus tendon. This opening is usually slightly wider above than below, measuring fifteen millimetres above and twelve millimetres below as an average in forty joints. It is always obliquely directed, the lower opening being internal.

Posteriorly the external semilunar sends its main attachment to the middle part of the interspinous space, and also sends a strong band to be attached parallel to the posterior crucial on the femur. These bands were noted as follows:

Inserted anterior to posterior crucial	11
Inserted posterior to posterior crucial	5
Split, one strand in front, the other behind	20
Absent	4
	40

Sometimes these bands blended with one or the other crucial, and sometimes they remained distinct to their point of insertion.

The internal semilunar has no break in its peripheral attachment, but on the contrary is firmly attached to the internal lateral ligament which holds it very closely to the tibia. Posteriorly it sends a fibrous end in between the posterior crucial and the tibia, to be attached to the non-articular surface of the internal tibial spine, and in front it blends with the origin of the anterior crucial ligament in front of the internal spine.

In structure the semilunar fibrocartilages are composed of fibrous tissue, with fibres arranged parallel to the periphery, covered above and below with a layer of cartilage. The thickness of the structure at its periphery as compared with its free margin is due to a greater proportion of fibrous tissue rather than to any thickening of the cartilage layer, which is indeed thinner here than at the free border. On cross-section some vertical fibres of the capsule can be seen to pass into and blend with the horizontal fibrous core of the semilunar both from above and from below. The greater strength of the lower fibres, which are in no other way to be distinguished from the capsule, probably accounts for the separate name of "coronary ligaments."

The transverse ligament is a continuation of the semilunars and usually connects the two in front. It is not a constant affair of appreciable size. Its absence was noted in sixteen joints, and in eight it is recorded as threadlike out of seventy-three recorded. It may be a continuation of either semilunar. Five times it was continuous with the internal only and twice with the external. When this arrangement exists, its free end spreads out into the mass of fatty tissue

below the patella. This practically agrees with Higgins's observations,[2] and makes it difficult to agree with Pauzat's[3] conclusions as to its great importance.

At the inner side of the joint, the internal lateral ligament is firmly attached to the semilunar as before described, and at this point neither has motion independent of the other. On the outer side, the band of fibres called the anterior or long external lateral ligament has no connection with the outer semilunar, and frequently its synovial bursa is interposed. Internal and behind this, the posterior or short external lateral ligament, which is a part of the capsule, is separated from the semilunar by the opening through which the popliteus tendon passes.

Both semilunars have some freedom of movement independent of femur and tibia, though they only move with the joint capsule. The simplest description of their movements is to say that in flexion they move with the tibia, and in rotation with the femur. In full extension, they approach each other in their centres, and in flexion to a right angle or more their centres are somewhat separated. This is as might be expected from the divergence of the femoral condyles.

The external has much greater freedom of movement than the internal, lacking the restraint of anything like the short and powerful internal lateral ligament. Pauzat and others assert that their excursions in the joint are governed by muscular attachments; but the writer believes that their movement is entirely passive. They certainly move freely in a normal cadaveric knee.

The tibial surface exposed by the semilunars, when carrying no weight, is always larger than the surface of femur in contact in any normal position of the joint. When the knee is put under pressure in a vise, the external semilunar can be made to fit the external condyle snugly in extension, but in no other position. The internal cannot be made snug. In other words, the semilunars are not so well placed to carry the weight of the body, whether standing or with bent knees, as they are to assist the lateral ligaments of the opposite side,

and to limit the excursion of the condyles from the tibial spines.

For example, if the internal semilunar be removed with as little damage as possible to the capsule, the joint works well in flexion, rotation, and extension, until some force acts to bend the knee outward. Then it is evident that the external lateral ligaments are insufficient to prevent an increase over the normal motion in this direction. The same is true of forces acting to bend the knee inward after removal of the external semilunar. With the removal of both, this fact becomes still more evident, and the lateral motion of the knee is increased from about five degrees to fifteen degrees or more.

With both semilunars present, these lateral movements are resisted not only by the opposite lateral ligaments, but by the horizontal fibres of the semilunars, and the increased tension of the crucials as the femur and tibia are separated by the wedge of fibrocartilage. With a semilunar absent the corresponding femoral condyle is free to slip down away from the tibial spines, with nothing to stop it save a flexible guy on the other side of the joint.

In full extension there is probably little weight carried on the semilunars unless there be side pressure. With any lateral strain on the joint, the semilunar on the side *against* which the force is exerted becomes immensely important in preserving the stability of the joint. In flexion the internal condyle rolls back on to the internal semilunar if the leg be rotated out, and this comparatively fixed part of the cartilage probably sustains some weight under these conditions, though most of the pressure comes through the external condyle in this position.

A small but constant artery runs around the periphery of each cartilage where the capsular fibres blend with it.

The joint cavity is enclosed by a synovial membrane, external to which is a covering of fibrous tissue thickened in certain locations and added to in others by the endings of active or outgrown muscles.

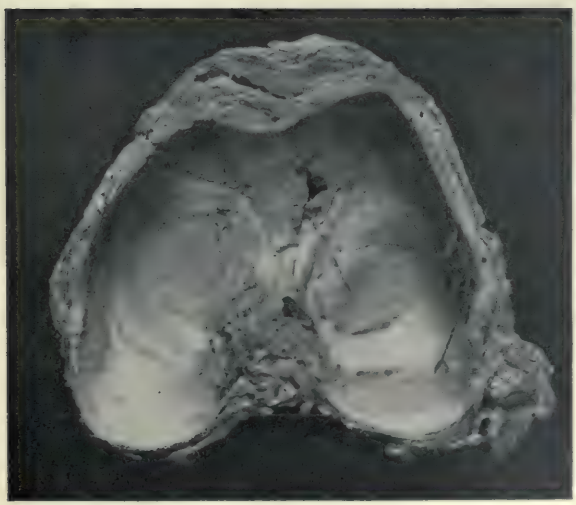
Of the ligaments which may be considered thickenings

PLATE VIII.



Same as Plate VII, back view.

PLATE IX.



Lower part of right capsule hardened in formalin. Femur removed, showing semilunar cartilages and crucial ligaments.

PLATE X.



Vertical transverse section through lateral ligaments left knee, joint extended.
Front view of section.

of the capsule, the internal lateral is the strongest and shortest, and is said to be the vestige of a long adductor magnus tendon to the tibia.

On superficial dissection, it appears fan-shaped, with fibres radiating from the prominence on the internal femoral condyle. In horizontal sections the bulk of the fibres can be seen to pass almost directly downward to be attached to the floor and margins of the groove for the semi-membranosus on the tibia, while only the most superficial fibres have the radiating arrangement—an anterior set passing down under and almost as far as the gracilis tendon, while the posterior fibres swing around even behind the internal condyle into the posterior part of the capsule.

Its length as measured on the outside of a dissected joint is much greater than that of its shortest fibres which are in contact with the synovial membrane and the semilunar cartilage.

Its working length is, of course, no greater than that of these shortest fibres, which do not measure over three and one-half or four centimetres,—twelve joints measured.

The function of this ligament is to guard against strains tending to bend the knee inward, to prevent over-extension of the joint, to limit rotation of the leg and foot, and to assist in carrying the leg weight when the foot is off the ground. It also greatly limits the movements of the internal semilunar fibrocartilage.

The external portion of the capsule is supported by the long external lateral ligament, the popliteus and the biceps tendon, and consequently shows less thickening than the internal part.

The long external lateral ligament shows plainly its connection with the upper end of the peroneus longus, and is said to be a vestigial attachment of that muscle. It is long and slender, and always has something of a synovial bursa about it, sometimes entirely surrounding it, so that the ligament is not attached to the capsule.

The biceps tendon is not only inserted into the fibula and

tibia, but its tendon blends with the posterior and outer part of the capsule from the origin of the outer head of the gastrocnemius down. It can be separated from this part of the capsule only by a forced dissection, and cannot fail to take some of the side strain of the joint in extension.

Under these two lies the capsular thickening called the short external lateral ligament, which is less sharply defined than the internal lateral. These fibres also radiate from a prominence on the external condyle, and pass down to the tibia and fibula; but the shortest fibres are on the average one centimetre longer than on the inner side of the joint, thereby allowing more movement of one bone on the other than can take place at the inner side.

The function of the external lateral ligament and its assisting structures is to resist strains tending to bend the knee outward, and in other respects to act with the internal lateral in limiting external rotation of the leg, and carrying a share of the weight when the foot is lifted from the ground.

The posterior part of the capsule consists of two hoods which cover the two femoral condyles between the lateral ligaments and the crucials. At the popliteal notch they blend with the posterior crucial ligament. On the tibia they are attached just below the margins of the articular surface, except as the external continues on the posterior surface of the popliteus with the expansion of the semimembranosus, and on the femur they are attached very near the edges of the articular cartilage.

Superficial to this, but under the gastrocnemius, lie some oblique fibres of irregular arrangement and size which are grouped as the "posterior ligament of Winslow." In a general way they run as slender fibrous bands from the place where the semimembranosus tendon reaches the capsule to the upper and outer side of the popliteal notch. One or two strong bands usually arise from the semimembranosus tendon itself, but most of these strands have no connection with it, and seem better adapted for furnishing an elastic bed for the popliteal artery and preventing its kinking in flexion than for strengthening the articulation. The experiments of Poirier [1] point

to the same conclusion. In two joints out of sixteen, some of the strands were so directed that they could possibly draw both semilunars backward as the semimembranosus contracted, but other dissections indicated that this was an exceptional arrangement.

In full extension the attachments of these posterior hoods to the tibia and femur are separated about five centimetres, while in flexion the distance is reduced to a single centimetre. This slack of the capsule in flexion is taken up by the two heads of the gastrocnemius which not only cover the two hoods behind, but take origin from them for a distance of about two centimetres.

The patella has a thick layer of cartilage on its posterior surface, even thicker than the layer to be found on the trochlear surface of the femur. This surface is convex in all diameters, most convex from side to side.

With complete contraction of the quadriceps, the whole of the articular surface of the patella is raised above the articular surface of the femur. With knee extended and quadriceps relaxed, the lower half or third of the patellar cartilage is in contact with that of the femur.

During flexion the patella slides down, having more contact with the external than with the internal condyle. With the knee bent to a right angle or completely flexed, its contact is very slight with the internal condyle, being one centimetre or less in width. Even this contact can be lost, and the inner border of the patella may slip in between the condyles.

In a kneeling position with the joint bent to a right angle most of the weight of the body is carried on the patella. When the joint is completely flexed, the body weight is carried on the tubercle of the tibia.

The bursæ in front of the patella and that beneath the patella tendon have always been found when sought, and the latter, though separated from the synovial cavity of the joint by a thin partition, has never been found to communicate with the joint.

English and American text-books of anatomy are curi-

ously silent as to the lateral ligaments of the patella, and the latest German book does not even mention them. One or both existed in each of twelve joints dissected carefully, and the internal was identified in fifteen other joints taken at random.

The internal is much the stronger, and is a flat, triangular band passing from the prominence on the internal femoral condyle to the upper half or two-thirds of the inner border of the patella. It is a distinct band at its origin, has many almost horizontal fibres of the vastus internus inserted into its anterior surface, and finally, covered by the muscle, mingles with the complex fibres of the quadriceps aponeurosis surrounding the patella.

The external is thinner, narrower, and weaker, and was not found in two joints out of twelve as a distinct structure, though even in these there were a few slender transverse fibres. When present it passes horizontally forward from the prominence on the external femoral condyle to the upper third of the external border of the patella. It is interlaced with fibres of the iliotibial band and with the extensor aponeurosis near the patella.

The function of these ligaments is to steady the patella as it slides on the femur, and prevent lateral slipping or dislocation, and, as the strain is greater on the internal than on the external, the internal is not only much stronger, but it is reinforced by the lower vastus internus fibres which are inserted on its anterior surface.

The ligamentum mucosum is a thin, vertical partition of synovial membrane between the two sides of the joint. It has a free upper border which extends from just below the patella to the anterior crucial ligament. In a total of fifty-eight cases where it was noted, it was apparently lacking in two, and in two other cases the ligament had evidently been torn. It was a mere thread in eight cases, a band with an opening below it in four cases, and in nine cases it was a complete ligament.

The mucosum may be a vestigial structure, but is of present use in holding the anterior synovial pad against the femur.

PLATE XI.



Sagittal section through internal condyle and tibia, left knee, outer side of section, joint extended.

PLATE XII.



Sagittal section through external condyle and tibia, left knee, inner side of section, joint extended.

PLATE XIII.



Right knee, internal lateral ligament.

PLATE XIV.



Right knee, external lateral ligament.

PLATE XV.



Internal patellar ligament and synovial pouch on front of extended joint, right knee. Joint cavity distended with wax. Upper and lower margins of patella marked by black lines.

There is some confusion in the literature as to the structures to which the name "alar ligaments" belongs. An instance of this is found in Allingham's [4] monograph, where he quotes Lang's description of the alar ligaments as "fringes of the ligamentum mucosum;" . . . "in many cases hard and cartilaginous; . . . always found to be introduced between the femoral condyle and the anterior portion of the semilunar fibrocartilages in complete extension." This description evidently applies to the postero-inferior free margin of the infrapatellar pad.

When the joint is opened by a transverse cut above the patella and this bone is turned down, two tense folds of synovial membrane can be seen passing forward from the ligamentum mucosum to the sides of the patella. These answer to the description of alar ligaments given by Morris and others, but do not appear on the interiors of joints hardened in formalin, from which the femurs have been subsequently removed. Their apparent continuation as two fibrous folds of the extensor aponeurosis on either side of the patella projecting backward into the joint can always be seen, though the external is much less prominent than the internal. The writer believes with Pauzat [3] that the synovial folds appear only in certain positions which do not exist in life. Pauzat has traced distinct bundles from the fibrous folds above described to the anterior ends of the semilunar fibrocartilages, and believes that they serve to pull the semilunars forward and up with the contraction of the quadriceps. The writer has not traced such bundles, but has found these folds spreading out generally into the fibrous framework of the infrapatellar pad, and believes that their function is to pull this pad forward and up out of harm's way during extension.

Within the joint there are several pads covered with synovial membrane, which are composed of fat, fibrous tissue in varying amounts, and blood-vessels. The largest of these pads is attached to the extensor tendon below the patella and is rather triangular on section. The broad base is in contact with the femur, and the two free extremities of the base

project upward between the patella and femur, and backward between femur and tibia. The lateral boundaries of this pad are usually well defined, being opposite the margins of the femoral condyles. It is held in contact with the condyles by the tension of the ligamentum patellæ and the mucosum.

The pad shows a tendency to become lobulated, and the lobules to develop pedicles. These lobules are of two kinds, —one composed of fat covered with synovial membrane, soft, and often ending in fine fringes as if it had been caught and frayed between the adjacent bones, the other composed of tough, fibrous tissue, pediculated, and never frayed or fringed.

Besides this largest fatty and synovial pad, there is a smaller one loosely attached just above the articular surface on the front of the femur, which is in contact with the patellar articular surface in extension. This shows smaller lobules which are often fringed. Two other small pads are found posteriorly in the joint just above the attachment of the two semilunars to the posterior part of the capsule. In two cases fibrous strands from these were found over the external semilunar cartilage, but none were found over the internal. These are the only pads which are constant, but often small ones were found on the front and outer side of the anterior crucial ligament, and projecting from the synovial membrane on the sides just above the attachment of the semilunars to the capsule.

One function of these pads seems to be that of " wipers," which keep the synovial fluid spread evenly over the patellar cartilage and the condyles of the femur. They also increase the area of synovial membrane which secretes this fluid, and possibly this is their chief function.

The synovial cavity of the knee-joint is very extensive, the synovial surface being much greater than that of any other joint in the human body. The capacity of this joint is nevertheless not large, but varies according to the presence or absence of accessory cavities communicating with the joint.

In testing the capacity of the knee, a series of fourteen undissected joints was taken, all about the average size and

adults. From a graduated reservoir two metres above the subject, a column of water was used to produce a pressure approximately that in the human arteries. The results varied as follows:

	Right. Cubic Centimetres.	Left. Cubic Centimetres.	
1. Female	80	90	No bursæ.
2. Male	200	180	Large bursæ about semimembranosus and biceps tendons.
3. Male	120	170	Small bursæ about semimembranosus tendons.
4. Female	90	80	No bursæ.
5. Female	120	84	Rheumatoid. Left anterior crucial ruptured. Free bodies. Bursa around right external lateral ligament communicates with biceps bursa and joint cavity.
6. Male	100	90	No bursæ.
7. Male	180	200	Large bursæ about biceps and semimembranosus.

With extended joint, this fluid was almost all anterior to the lateral ligament and under the quadriceps expansion. With joint flexed the fluid was forced to the back of the joint. After all the fluid had entered an extended joint that would, some thirty centimetres more would flow in if the joint were slightly flexed, and after this some little force was required to hold the knee in extension again. The patella could always be made to "float" after the admission of thirty cubic centimetres of fluid. Lübbe,[5] Picqué,[6] Meisenbach,[7] and O'Conor[8] report cases of hæmarthrosis from which blood has been aspirated in amounts varying from 130 to 180 cubic centimetres.

In no case has a large cavity been found under the quadriceps, the bursa extending upward less than seven centimetres, and communicating with the rest of the joint in every case which can be recalled. No notes were made on this. Higgins[2] reports that 98 per cent. of cases show such communication.

In extension there is a synovial cul-de-sac above and on either side of the patella where synovial membrane is in contact with synovial membrane. This disappears during flexion.

The anterior wall of the sac is intimately connected with the extensor aponeurosis, and the posterior wall lies loosely against the non-articular front of the lower end of the femur internal and external to the patella. It extends about five centimetres above the level of the upper border of the patella, and usually communicates freely with the bursa under the quadriceps expansion. Laterally, it slopes down to pass under the lateral ligaments of the joint.

Summary of Movements.—The *fully* extended joint is without lateral motion, anteroposterior motion, or rotation. All three movements are present to some degree after slight flexion and increase up to right-angled flexion, after which they diminish again.

Extension is limited first by the posterior crucial. After rupture or section of this ligament, extension is still further increased by rupture or section of the anterior crucial, and later after rupture of the internal lateral and external lateral ligaments.

The oblique or posterior ligament of Winslow resists this motion little, if any. Flexion is limited by contact of the soft parts.

External rotation is limited by the two lateral ligaments and increased after section or rupture of either.

Internal rotation is limited by the internal lateral and anterior crucial in combination, and increased after section or rupture of either.

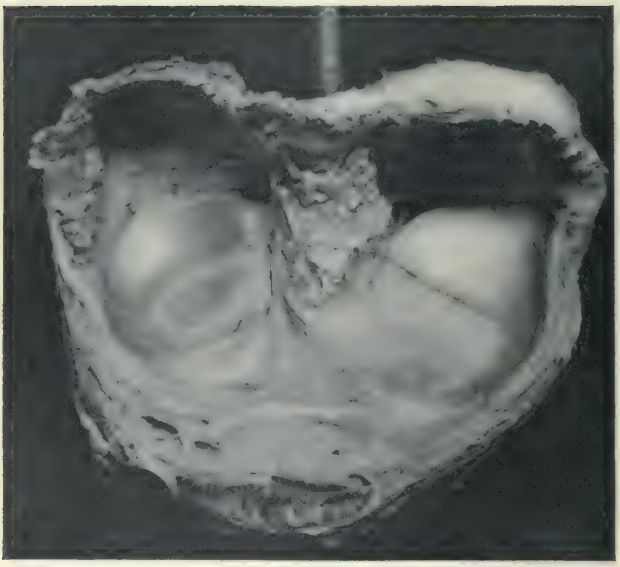
A slight forward slipping of the tibia on the femur is possible in external rotation, but is stopped first by the anterior crucial, and later by the two lateral ligaments. A slight backward slipping of the tibia on the femur is also possible on external rotation, but is limited first by the posterior crucial and later by the two lateral ligaments. Adduction and abduction are also possible in external rotation to a degree which can be felt with the hand on the joint. Adduction is limited first by the external lateral ligament, and later by the posterior crucial. It is also increased on the cadaver after removal of the internal semilunar. Abduction is limited first by the in-

PLATE XVI.



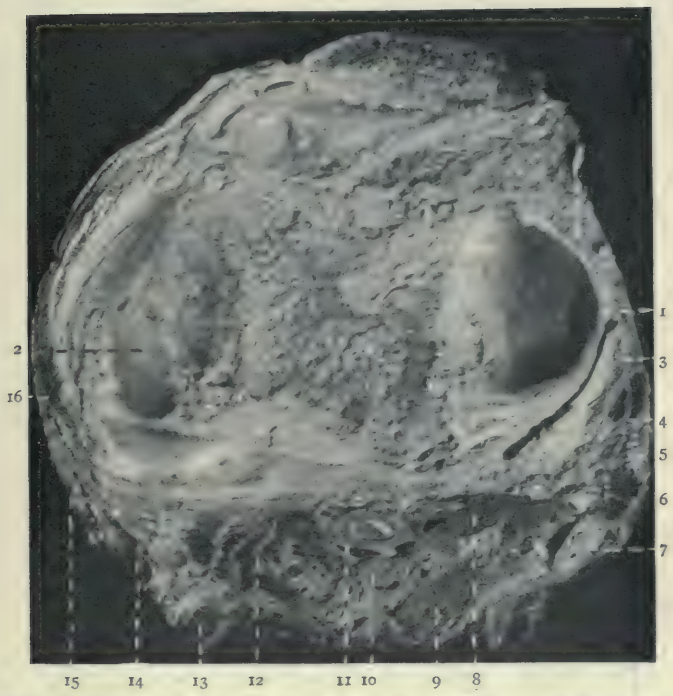
External patellar ligament and synovial pouch. Same joint as Plate XVI.

PLATE XVII.



Right knee, specimen hardened in formalin. Femur removed, showing two posterior hoods of the capsule.

PLATE XVIII.



Horizontal section through right knee, joint hardened in formalin. Section passes through middle of internal semilunar cartilage and just above middle of the external.

1. External semilunar.
2. Internal semilunar.
3. Slit between popliteus tendon and external semilunar.
4 and 5. External lateral ligaments.
6. Biceps tendon.
7. External popliteal nerve.
8. Plantaris.
9 and 12. Gastrocnemius.
10. Internal popliteal nerve.
11. Popliteal artery with veins between it and nerve.
13. Tendon of semitendinosus.
14. Tendon of semimembranosus.
15. Tendon of sartorius.
16. Internal lateral ligament.

PLATE XIX.



Infrapatellar pad showing tabs, left knee.

ternal lateral, and later by the posterior crucial. On the cadaver abduction is greater after removal of the external semilunar.

SURGERY.

Among these 150 cadaveric joints were found examples of nearly every "internal derangement of the knee-joint" which has yet been described, as well as two which may be properly included under the same head, and which have not been described in print heretofore, so far as known.

A classification of internal derangements according to their frequency in my series of joints would be

1. Tabs from the lubricating apparatus.
2. Erosion of cartilage.
3. Damaged and displaced semilunar cartilages.
4. Ruptured ligaments.
5. Free and loose bodies.
6. Villous or papillary synovitis, of which no instance appeared in these joints, and which will not be discussed. Hoffa [9] describes another condition as "atrophy of the quadriceps," which allows the capsule to catch between patella and femur or femur and tibia. He describes it from the double stand-point of surgeon and patient, and says that the condition usually dates back to some injury which requires rest in bed for a few days. It is curable by massage and gymnastics. My studies of cadaveric knees make me doubtful of the possibility of catching any portion of the normal synovial membrane except the tabs from the lubricating apparatus.

1. TABS FROM THE LUBRICATING APPARATUS.—Plate XIX.

The most frequently injured structure among my joints was the infrapatellar pad. Its condition was noted in 100 joints, and in every case there was some evidence of damage, unless the fine fringes on the edges of the soft fatty pads may be said to be normal constituents of the adult joint. These fringes were constant both for the part of the pad next to the femoropatellar contact and that nearest the femorotibial contact. During flexion the edge of the pad nearest

the femoropatellar contact may be caught, and during extension the edge nearest the tibia. The suprapatellar pad often showed something of the same condition caused by its catching between the patella and femur during flexion, but here the apparent damage was less than below.

In either location a slight dryness of the joint will permit of a catch and pull, if not an additional crush of a tab.

No other joint in the body presents so favorable an arrangement for internal injuries, which, though slight and comparatively painless, may open both the lymphatic and general circulation into its cavity, and no other is so often attacked in the course of a general infection.

In one joint with marked loss of articular cartilage, where there was actual bony contact between patella and femur, with grooves and ridges worn in both, there were no fatty or fibrous tabs. Both pads were shrunken, and the fat was so largely absorbed, that the fibrous framework which is usually scarcely to be seen on the surface was more apparent than the fat.

Whether a loss of synovial secretion from an atrophied pad increased the friction between patella and femur and caused a wearing away of the articular cartilage is not known. The condition was interesting and unique in this series.

In twenty-two joints out of 100 noted there were seen tough fibrous tabs, pediculated and attached to the infrapatellar pad. These were situated as follows:

Internal to mucosum only in	18 joints.
External to mucosum only in	2 joints.
Both internal and external	2 joints.

These tabs were without fringes and were never found crushed, but in three joints were found injuries on the anterior part of the external semilunars which could be accounted for by a crushing force exerted through this tab in extension. These were the only semilunars seen with this injury.

There are but few references in the recent literature to operations for the removal of fatty and fibrous tabs as such. Some reported as growths from the synovial membrane above

the patella were possibly tabs from the suprapatellar pad. Others described as fringes of the ligamenta alaria are evidently tabs from the infrapatellar pad.

Goldthwait [10] removed tabs and fibrin masses from nineteen out of thirty-eight knee-joints opened. Allingham [4] removed them in two cases out of fifty-nine joints opened, and Turner [11] in three cases out of twenty-nine.

From my study of the cadaveric knees, it seems as if a much larger number of individuals must suffer from the conditions which appeared in connection with the supra- and infrapatellar pads than Allingham and Turner's figures indicate.

Where these form a mechanical obstacle to the perfect working of the joint, they can only be removed by mechanical means. The only treatment is operation.

2. EROSION OF ARTICULAR CARTILAGE.—PLATES XX, XXI.

A frequent injury found in these joints was seen on the articular cartilage at the back of the upper surface of the external tibial tuberosity. The damaged area usually measured a little over a centimetre in diameter, and was always rounded. It was noted as follows:

Normal tibial surfaces	59
Softened tibial surfaces	19
Old fibrous surfaces	43
Not noted	29
	150

It showed all stages from a shallow cracking or "crazing" of the smooth cartilaginous surface to bare bone with a few tufts of fibrous tissue projecting from the edges and from small centres inside the bare space. Five joints in which the "lipping" of bone was well marked showed normal cartilaginous surfaces at this point. There was no constant relation between this condition and gross injury to the semilunar.

Dorsal decubitus with antemortem or postmortem maceration might be suggested as a cause for this condition, but

one-third of all these joints showed tough fibrous tissue in place of the articular cartilage which would indicate antemortem change. Moreover, if it result from maceration, the damage should be as evident in the synovial pouch under the popliteus, which is lower than this tibial area in the dorsal position. This was not found to be the case. The appearance of these areas suggests mechanical damage rather than maceration.

If an individual is kneeling for any considerable time, the fluid contents of the joint must gravitate towards the patella, leaving the back part of the joint comparatively dry, and most individuals when working on their knees do so with internal rotation of the leg, which brings this part of the tibial surface in contact with the back of the external condyle of the femur.

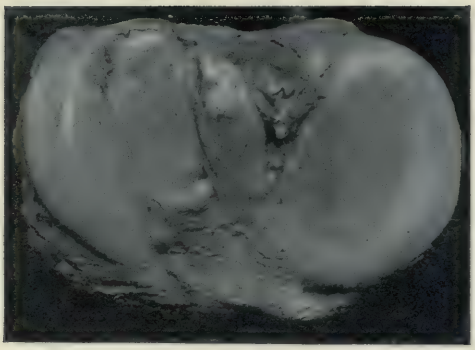
The first movement, on rising to the standing position, is to draw one foot forward and plant it on the floor, putting this knee in nearly complete flexion. Then extension begins with the entire body weight resting on this knee. This gives us motion with a maximum of pressure and a minimum of lubrication as a possible cause for the damage seen.

If this condition exists as often among those whose work is done while kneeling as in this series, it perfectly accounts for the stiffness and difficulty with which they rise to their feet, and the absence of stiffness and pain when they are erect and walking about.

Another pathological condition was a loss of cartilage along the inner border of the patella. Where the cartilage appeared normal, there was often a fraying out of the edge of the internal alar ligament, or of the loose tissue lying partly covered by the alar and between it and the inner edge of the patella.

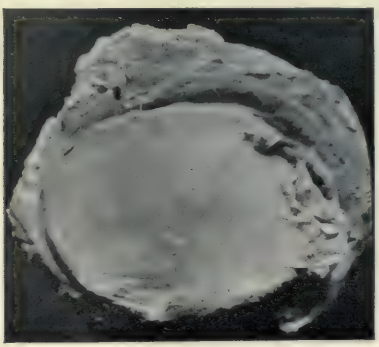
In right-angled flexion the main contact of the patella is with the external condyle, there being normally about one centimetre of its width in contact with the internal. With a lateral movement while kneeling, the inner edge of the patella might be forced into the popliteal notch, provided the internal

PLATE XX.



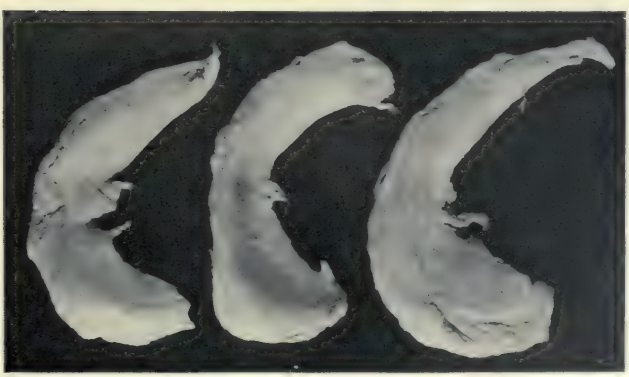
Articular surface right tibia, showing erosions at back part of external tuberosity.

PLATE XXI.



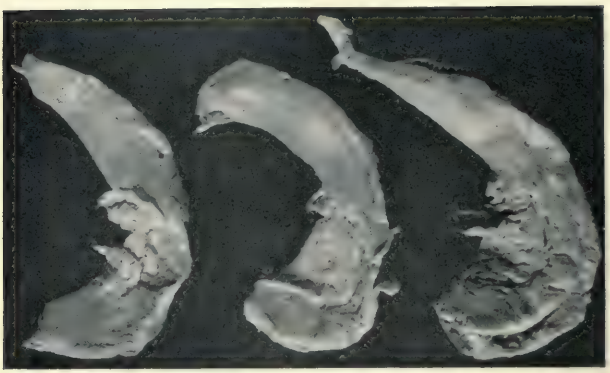
Left patella, showing damage to articular cartilage at inner margin.

PLATE XXII.



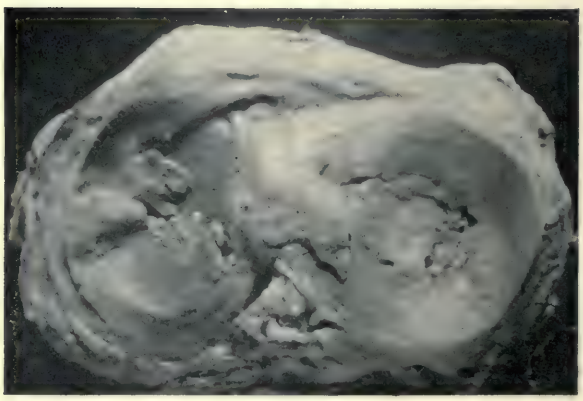
Three right internal semilunar cartilages, showing fracture opposite internal lateral ligament upper surface.

PLATE XXIII.



Same as Plate XXII, under surface.

PLATE XXIV.



Semilunars of right knee, showing effects of long-continued friction.

patellar ligament is stretched or torn. The damage is done as the patella slips from beneath the outer edge of the internal condyle, and occasionally a less degree of injury was found there. Usually only the edge of the patellar cartilage was worn off, but at times an area one centimetre across was found with the cartilage layer worn through and strips or short tabs of fibrous tissue in its place. It is probably one of the least disabling of all the injuries found.

3. DAMAGED AND DISPLACED SEMILUNAR CARTILAGES.—PLATES XXII, XXIII, and XXIV.

The most striking injuries in my 150 joints were found in connection with the semilunar fibrocartilages, and these were noted in all of the joints examined. They have been grouped as follows:

Joints with both semilunars damaged:

Both crushed and torn for most of their cartilaginous portion		6
Split or torn from capsule 4	Internal, fringe on external	2
	External, fringe on internal	1
	Both	1
Internal showing wear under posterior part up to lateral ligament with external slightly worn		4
Both showing fine fringes on edges		1
		15

Joints with damaged external and normal internal semilunars:

Strands and fringes projecting	4
Split or torn from capsule	3
Transverse break	3
Showing damage on under surface only	2
Adhesions above	1
	13

Joints with damaged internal and normal external semilunars:

Transverse fracture at attachment of internal lateral ligament	2
Transverse fracture with splitting or tearing from capsule	1
Transverse fracture with wear on under surface only	5
Wear on under surface without complete fracture	4
Split or torn from capsule	2
	14 = 42

Grouping all the damaged internal semilunars together there were:

Showing decided injury	24
Showing only fringes along the edges	5
	29

The same grouping of the damaged external semilunars gives:

Showing decided injury	18
Showing only fringes along the edges	10
	28

Of these forty-two joints, twenty-four were noted as showing some of the marks of inflammation or degeneration of articular cartilage, and doubtless more would have shown under a microscope the earlier changes which are associated with this condition. The important thing, so far as the semilunar cartilages are concerned, is the dryness and consequent friction which is almost always present in some stage of the condition.

The first noticeable effect of friction may be expected to show in the appearance of fine fringes or strands at the edges of the semilunars after the cartilage layer is worn away. Or, one or both of the semilunars may be caught between the moving femur and tibia and split longitudinally somewhere between their free edge and their capsular attachment as described by Barker [12] and others. If both remain attached to the capsule, they may be worn down to the fibrous core, which itself may be torn and irregular as shown in Plate XXIV.

These injuries may all take place as a result of friction while the ligaments retain their normal adjustment, but long-continued friction must ultimately result in ligamentous damage through the strains produced by catching the semilunars and wedging the bones apart.

In many of these joints it has been impossible to decide whether the dryness and friction preceded or followed the ligamentous injury. Injuries to the knee which are classed as acute synovitis or sprain, and are not seriously disabling at the time, occur frequently among young patients, who are less likely than the subjects from which these joints were taken to show degenerative changes. So it has seemed worth while to study the results of extreme movements on the ligaments, and the relation of ligamentous damage to the more obvious injuries seen on the semilunars.

Experimental work on the cadaver cannot reproduce the conditions during life, but some of the results are worth considering. First, do the ligaments of the knee tear off their bony attachments, or do they rupture in their continuity?

The results obtained by Segond,[13] Poirier,[1] Bonnet,[14] Pagenstecher,[15] Hoenigschmied,[16] Jersey,[17] and myself indicate that on the cadaver ligaments almost invariably tear from their bony attachments (usually from the femur), and usually with fragments of bone attached, Larsen[18] reports an operation for a loose osseous body in the knee attached to the femoral end of the anterior crucial ligament. Swan[19] and Fürbeck[20] both report similar operative cases. Pagenstecher reports three operative cases with rupture of the femoral attachment of the crucial ligaments, and Battle[21] and Robson,[22] one case each. So far as cadaveric experiment and the reported operative cases go, it seems most likely that the crucial ligaments at least, and probably the laterals as well, are torn from their bony attachments more often than in their course.

Hints[23] is evidently of the contrary opinion, but presents neither experiment nor operative case to confirm his opinion, and quotes one description of Dittel's which directly states the existence of such an injury.

Second, What ligaments rupture?

Hints has gathered reports of thirty-four cases of rupture of the lateral ligaments of the knee with and without other ruptured ligaments. None of these cases were complicated by dislocation of the bones. Thirty-one of these were cases of rupture of the internal lateral and three of the external.

The experiments of Segond on the cadaver show that abduction alone or abduction combined with either rotation will rupture the internal lateral ligament by itself, also that adduction alone or combined with either rotation will rupture the external. With rotation alone, he always fractured the bones below the knee before any damage was done to the ligaments, and he quotes Bonnet as having had the same experience.

As to hyperextension, the results of his experiments agree with those of Poirier, who found the internal lateral remaining intact until after rupture of both crucials. Hoenigschmied was able to rupture the internal lateral ligament by external rotation, and the anterior crucial and internal lateral by internal rotation, without producing bony fracture.

Pagenstecher was able to tear the anterior crucial ligament from the femur by strongly flexing cadaveric knees over a round stick in the popliteal space, and also by combining complete flexion with adduction and internal rotation.

The cases of ruptured crucial ligaments in the living reported by him and by Battle and Robson will be referred to later.

Practically, all of these observers agree in giving the immediate results of these ligamentous ruptures as we should expect, and they may be tabulated roughly as follows:

Ruptured.	Increased Movement.
Internal lateral.	Abduction and both rotations.
External lateral.	Adduction and external rotation.
Anterior crucial.	Internal rotation and forward slip of tibia on femur.
Posterior crucial.	Internal rotation, extension, and backward slip of tibia on femur.

The effects of these increased movements on the semilunar cartilages do not seem to have been studied except as the semilunars were damaged at the time of injury.

So long as the normal knee is kept in a position of internal rotation, the articular surfaces of femur and tibia are in such close contact that it is impossible to catch the semilunar fibrocartilages between the two articular surfaces. With external rotation and a dry joint it is possible to catch the internal semilunar if the joint be moved slowly, but it will not hold unless the internal lateral ligament gives way.

In twenty-four undissected joints one was found in which the internal semilunar caught and held under this manipulation. This joint had a noticeable increase of lateral movement, though no recent injury showed on dissection. In the other twenty-three joints the internal semilunars caught after section of the internal lateral ligament, at its femoral attachment, sufficient to allow an equal increase of lateral motion, which means, of course, an increase in external rotation.

If the femur be free to roll up on the posterior part of the internal semilunar, it may simply hold it for a moment and then squeeze it back as one " snaps" an apple seed. This may not damage the cartilage for some time, but when the ligaments have become stretched by repeated pulls or by some new and greater violence, the condyle can roll entirely over the semilunar and settle down behind it.

The joint is now locked in flexion, and must be unlocked by abduction combined with internal rotation and extension. Apparently the most common result of this anterior dislocation of the internal cartilage is that the posterior portion is pushed forward until stopped by its firm attachment to the internal lateral ligament, and opposite this attachment a bend or transverse fracture of the semilunar occurs. With repetition the cartilage layer underneath the semilunar is cracked off or worn through, and fibrous tabs appear at the point of fracture which may project over the uncovered tibial surface.

This has been the most common injury to the internal semilunars seen in these joints, appearing in twelve of the

fourteen where the internal only was damaged, and to a less degree in four of the fifteen joints in which both showed injury. Plates XXII and XXIII show three internal semilunars with this injury.

One joint shown on Plate XXV shows another possible result of over-riding. In this joint the internal semilunar has been torn from its capsular attachments all the way around and turned wrong side up into the intercondylar space, where it lies against the crucial ligaments with no tendency to return to its natural position. Croft,[24] Barker,[12] and Logan-Turner [25] have found this condition in the living.

Several examples of another condition appear in the literature, though it is not the most frequent injury, as stated by Hoffa.[9] The internal semilunar is torn from its anterior tibial attachment and the free end may or may not be turned up or folded back on itself. As a possible way in which it is produced, external rotation of the leg while the knee is flexed to a little less than a right angle and is bearing a heavy weight seems to me the most reasonable. At the same time, the internal lateral ligament must be partially torn from its tibial attachment to allow of any tension on the anterior attachment of the semilunar. No instance of this injury appears in my collection.

For the femur to over-ride the external semilunar cartilage greater looseness of ligaments is necessary, because, unlike the internal, the external semilunar has much freedom of movement and has the shape of a blunt wedge on cross-section. Considering a tear from the capsular attachment as evidence, there are three joints in which anterior dislocation of the external semilunar may have occurred.

4. RUPTURED LIGAMENTS.

"Sprains" and "acute traumatic synovitis of the knee due to strain" are scarcely to be found in recent literature outside the text-books. Ruptured ligaments, as such, appear but rarely, while dislocations are reported with some frequency, and the subject of "hæmarthrosis" of the knee-joint

PLATE XXV.



Complete dislocation of internal semilunar fibrocartilage, right knee. Both condyles sawn through vertically, and peripheral pieces turned out.

PLATE XXVI.



Left knee, showing results of rupture of anterior crucial ligament, and fringing of the upper portion of the infrapatellar pad.

has quite an extensive literature. Yet all of these are diagnostic names which cover varying degrees of ligamentous injury.

Hints's [23] collection of ruptured lateral ligaments has been referred to. Pagenstecher [15] has recently reported three cases of suture of the crucial ligaments in which the joint was opened three months, four days, and four months after the injury. In the first case, the posterior crucial ligament was found torn from the femur, and was sewn to the near-by periosteum with good result.

The second case showed an anterior crucial torn from the femur, which was also sutured with good result.

In the third case the anterior crucial was torn "near its insertion, atrophied," and was removed. Later, a free body was removed from this joint, and it became stiff as a result of some rheumatoid process. Robson [22] sutured both crucials to the femur eight months after injury with good result. Plate XXVI shows a joint with a complete rupture of the anterior crucial ligament.

Anterior dislocation of the external semilunar will not be so likely to result in damage to the cartilage itself as the same dislocation of the internal, because there is no fixed point behind which it will bend or break; but the "snap" with which the dislocation is reduced will be sharper than that on the inner side, owing to the different shape of the two semilunars on cross-section as shown on Plates XI and XII.

An extreme form of this injury appears in a museum specimen described by Godlee,[26] and has once been found at operation by Logan-Turner.[25] It corresponds to the dislocation of the internal cartilage shown in Plate XXV.

To allow anterior dislocation of the external semilunar, both the anterior crucial and the external lateral ligaments must be looser than normal. These two may be ruptured by extreme internal rotation combined with adduction, according to Segond.

If the femoral condyle overrides and settles down behind

its semilunar, and extension occurs while the joint is loaded heavily enough, the cartilage may be torn from its peripheral attachment and folded over into the notch. Otherwise, the dislocation will be reduced with the " snap," which accounts for the name " jerking" or " trigger" knee.[27]

It is possible that looseness of the external lateral ligaments may permit of sufficient external rotation to allow of a backward dislocation of the anterior portion of the external semilunar during extension, but no evidence of such a condition was recognized in these joints, and no such joint is described in the recent literature.

The only injury found exclusively on the external semilunar cartilages was a transverse tear at the junction of the anterior and middle thirds. This was seen in three joints of the four in which the tough fibrous tabs were found external to the ligamentum mucosum. It is possible that these tears may have resulted from the inclusion of such a mass within the well-fitting semilunar ring during extension, or when landing on the feet after a fall from some height. This connection was not noticed until the notes were tabulated and the joints thrown aside.

One hundred and twenty-eight operations on the semilunar fibrocartilages have been gathered from the reports of forty-seven different operators.

The pathological descriptions are so unlike that an accurate grouping of the conditions is almost impossible. The following is presented as approximately correct:

	Internal.	External.
Torn from or near anterior attachment	23	3
Transverse tear at or near lateral ligament..	38	..
Longitudinal split, incomplete	16	1
Longitudinal split, complete	8	..
Turned into intercondylar notch	3	1
Loose and sewn to tibia	23	3
Cystic	1	1
Ossified	..	1
Doubtful	1	5
	113	15

The "loose cartilage" is the most difficult to understand, for the anterior portions of both semilunars are normally loose in certain positions of the joint, and an increase in this would seem to involve a tear. Possibly such a tear might show on the under side of the semilunar, as in the cases seen by Barker [12] and in certain of my specimens.

Schaeffer [28] and others have treated mechanically disabled knees with an apparatus which permitted flexion while preventing external rotation and limiting extension and lateral mobility. If the disability be in the early stage before damage to the semilunar has occurred, this treatment has much in its favor; but if the semilunar has been fractured or torn off its anterior insertion, it is not easy to see how any apparatus can bring about a permanent cure even in function.

The exact diagnosis of semilunar injuries is as yet seldom attempted before opening the joint, and has often been uncertain even then. There is hope that by a careful study of the exaggerated movements, we may learn to locate the damaged ligaments, and thereby to reason out the semilunar injury resulting.

Suture of damaged cartilages has often been attempted, but it is worth attention that in later operations by the same men the damaged portions were removed. The opinion that removal is preferable to suture is now practically unanimous.

Thirteen days after injury, Battle [21] sutured both crucials to the femur and the internal lateral at some point, with good result. Two joints in my collection showed the results of rupture of the anterior crucial ligament.

On the other hand, cases of dislocation like Bergman's,[29] where the internal lateral and both crucials must have torn, and like Eames's,[30] five miners with the same injury, show that there are two sides to the question of repair. These six were all treated without opening the joint, and all recovered with useful knees.

Ligamentous damage of any degree must be followed by swelling. With a certain grade of injury the swelling

takes the form of an effusion within the joint. The more slowly the joint fills, the smaller will be the proportion of blood in the fluid. Pure blood has been aspirated from joints which filled within an hour after injury.

Lübbe [5] concludes, from a case reported by Kocher and one of his own, that blood may remain fluid in a knee for twenty-one days, or it may show clots after one day. He thinks the rapidity of clotting is directly proportional to the area of injured synovial membrane. He quotes Volkman as finding large masses of blood-clot as well as strong adhesions fourteen weeks after a contusion, while Delbastaille found that fluid blood in a very slightly injured knee was absorbed, except some pigment, within twenty-eight days. He believes that the rapidity of absorption is in inverse proportion to the synovial injury.

Three methods of treatment for these acutely distended joints are in use:

1. Rest followed by massage and movements. Lübbe [5] reports an average hospital stay of 34.6 days for twenty-two patients at the Seaman's Hospital in Hamburg, and thirty-eight days at a Copenhagen Hospital under this treatment.

2. Aspiration, repeated, if necessary, to relieve the distention and remove a material which would discourage movement and encourage the formation of adhesions.

From the Hamburg Hospital, Lübbe [5] reports an average stay of 25.5 days for thirty-two patients aspirated, and 22.4 days for the aspirated cases under Bondeson at Copenhagen. The great majority of writers [31] on this part of the subject favor aspiration, regarding it as safe if carried out with the most perfect asepsis, as shortening the time for recovery, and as giving better functional results.

3. Incision with drainage. O'Conor [32] is the most vigorous advocate of this procedure, and his conclusions after twenty-two successful consecutive arthrotomies are worth repeating.

"The question of draining gonorrhœal joints is settled."

" Washing out blood-clots from an injured joint is a surgical obligation." " Traumatic ' water on the knee' is best treated by arthrotomy and drainage."

He irrigates all his open joints with 1 to 1000 sublimate solution, and drains them until nothing but normal synovial fluid comes from the wound.

Whichever of these three methods be employed, the great probability of ligamentous injury ought to be kept in mind, an accurate diagnosis of the location and extent of the damage should be sought for by testing the joint for exaggerated movements, and the treatment should be directed not only towards an immediate recovery of function, but to the end that the ligaments may preserve the joint against further disability in connection with the semilunar fibrocartilages.

It may be that within a few years the early opening of these joints with immediate repair or removal of damaged structures will be the definite rule of procedure.

The writer believes that early or late repair of the internal lateral ligament, which is certainly the most accessible and probably the most frequently injured, will prevent some of the disability now caused by dislocation of its semilunar, and that in some cases it will be found to be a " surgical obligation."

5. FREE AND LOOSE BODIES.

Among my specimens there were but two which showed free bodies in the joint. In both they were small and numerous, and in both there was decided " lipping" of the margins of articular cartilage. Berry [33] removed 1047 free bodies from a joint which four years earlier had furnished him fifty. These consisted of a nucleus of cartilage surrounded by fibrous tissue and varied in size from a fine bead to a pea.

Thompson [34] removed several hundred from another joint, of the same structure with scattered areas of calcification.

Bazy [35] argues from his study of a similar case that these multiple bodies are the result of a dry arthritis with overgrowth of the articular cartilage at the margins.

Fowler [36] regards these as arising from embryonic cartilage cells in the synovial membrane.

The bony and cartilaginous masses found by Fredet,[37] Jaboulay,[38] Codman,[39] and many others are apparently of a different origin, and represent pieces of articular cartilage knocked off by direct violence, or pulled off with some ligament with or without bone tissue.

While these may consist of one, two, or even more fragments, they are not multiple to the extent found with the other type, and of course do not reappear as do the others.

Operations for removal of these bodies was successfully performed previous to 1803, according to William Hey.

Woodward [40] says that in 1860 Larry collected 131 operations for simple removal of free bodies. Where attempt was made to remove the body by direct incision 74 per cent. were cured, 4 per cent. were unsuccessful, and 21 per cent. died. The subcutaneous operation in two stages gave 49 per cent. cured, 38 per cent. unsuccessful, and 13 per cent. of deaths. Woodward collected 104 cases up to 1889 with six poor results, two amputations of the thigh, and one death.

Marsh [41] found seventy-two cases between 1885 and 1895, with no deaths, and sixty-two perfect recoveries.

I have tabulated 297 cases, all reported since 1895, including all sorts of operations on non-purulent knee-joints, with six resulting in ankylosis, no amputations, and no deaths. Operative removal of these free bodies is the only treatment to be considered to-day.

INCISIONS.

The uncertainty of our present methods of disinfecting the skin makes it desirable to arrange that the skin sutures shall not follow the lines of the incision in the capsule. This is accomplished by making a U-shaped flap of skin and turning it up or down to expose as much of the deep fascia as is necessary.

Incision 1. Beginning at the inner border of the patella, a finger's-breadth below its upper border, the incision runs downward nearly to the tibia, and then backward above the

internal semilunar to the internal lateral ligament. It can be extended above at the expense of the internal lateral ligament of the patella and back into the lateral ligament of the joint if necessary. This will expose the anterior two-thirds of the internal condyle, the anterior half of the internal semilunar, the lower portion of the anterior crucial ligament, the mucosum, and the inner half of the infrapatellar pad in its natural relations.

Incision 2. This begins with extended knee at the upper end of the outer border of the patella, passes downward to the upper border of the external semilunar, then backward along this upper border to the external lateral ligament. If this incision be carried up a little through the extensor fibres, it will expose the suprapatellar synovial pad. Otherwise, it will expose the anterior two-thirds of the external condyle, the anterior half of the external semilunar, the mucosum, and the outer half of the infrapatellar synovial paid in its natural position. The patella can also be tipped up so that practically the whole of its posterior surface can be examined.

Incision 3. This is made along the anterior border of the biceps, with extended knee, down to the capsule. Flexing the knee allows the biceps to pull back out of the way and the iliotibial band to partially cover the field. This latter can be nicked and drawn out of the way. The capsule is now lax and can be opened either above or below the popliteus tendon. Below the tendon, the incision opens into the pocket under the popliteus, which in the ordinary bed position is the lowest portion of the joint cavity. Through Incisions 2 and 3 the whole or any portion of the external semilunar can be removed.

Incision 4. With extended knee this follows the anterior border of the sartorius down to the capsule. The muscle draws back as the joint is flexed, and the capsule may be opened behind the main part of the internal lateral ligament, either above or below the semilunar. Through Incisions 1 and 4 the whole or any part of the internal semilunar can be removed.

The two posterior incisions in the capsule are short and give a small field for operation, but are sufficient for the purposes above mentioned, and will allow gauze drainage from the dependent part of the cavity, provided the joint is allowed to rest partially flexed. Otherwise, the two posterior hoods are in close contact with the femoral condyles.

A possible form of drainage is continuous irrigation, in through one posterior incision and out through the other. The fluid in this case would wash practically every portion of the synovial membrane, except, perhaps, the bursa, under the quadriceps.

The joint has often been opened by one of three transverse incisions which pass either above, below, or through the patella. Niehans [42] has suggested a long vertical cut internal to the patella which turns out at a right angle below the tibial tubercle. The patellar tendon is then chiselled from the tibia and turned up with the patella and front of the capsule.

These extensive incisions are not necessary for complete examination of the joint. The large openings increase the possibility of infection from the air, the operator, or assistant's mouth, and other sources. They prolong the period of immobility, and without exception they give a distorted view of the relations of the fatty pads to the articular surfaces.

A transverse incision may be found necessary to complete the operation in some cases. Under these conditions, the writer believes that sawing of the patella just below its middle, or preferably the section of the patellar tendon immediately below the bone, avoiding injury to the infrapatellar pad, will give the maximum of working-room with the minimum of later inconvenience in the use of the joint.

The writer desires to acknowledge his indebtedness to Professor Thomas Dwight for opportunity and material, to Dr. Franklin Dexter for the encouragement which started the investigation, to Dr. Harold C. Ernest for the use of his photographic apparatus and laboratory, and to Dr. S. B. Wolbach for the skill and patience which show in the photographic work.

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SOME REMARKS ON TUMORS OF THE CHIASM, WITH A PROPOSAL HOW TO REACH THE SAME BY OPERATION.[1]

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I WISH to report briefly a case of tumor of the base of the brain which came to my observation recently, and will close my report by a few remarks on tumors of the chiasm in general, and a proposal of how to reach such tumors by operation.

The case in question is as follows:

G. L., aged sixteen years, was admitted to the German Hospital, December 9, 1903, and died December 12, 1903. The patient was first seen on March 10, 1903, by an ophthalmologist, Dr. Denig, to whom I am indebted for the following notes: The patient complains of poor vision for five months; since that time he has had from four to seven attacks daily of neuralgic headache. Got into the habit of shaking his head at times, and of holding it turned slightly to the right. When five years old he went through an alleged attack of meningitis.

Vision: Right, minus 0.5, minus cyl. 2.25, horiz. vision, ⅓.
Left, minus 0.5, minus cyl. 1, horiz. vision, ⅓.

Pupils normal; perimetrical examination shows bitemporal hemianopsia, and right optic nerve shows a varicose vein. Probable diagnosis: old meningitis, with hydrocephalus internus, or, more probably, tumor of the chiasm, possibly with varicosity. Optic normal. (I include drawings of the results of the perimetrical examination.) (Figs. 1 and 2.)

Dr. George W. Jacoby, to whom the case was sent, takes the matter for a residuum of the meningitis which the boy experienced

[1] Read before the New York Surgical Society, February 24, 1904.

at the age of five. To exclude acromegaly, thyroid tablets are given. On the 28th of July, the vision on the right side ⅙, left ¼, a perceptible diminution. Slight hyperæmia in the vessels of the fundus. On December 8, the same vision as at the last examination. No other changes, except an increase of headaches. Had another consultation with Dr. Jacoby. Drs. Jacoby and Denig concur in the diagnosis of tumor of the chiasm, and decide on an operation to relieve pressure, with a view to a trial to extirpate the tumor.

My examination of the patient on December 10 showed the following: Family history negative; the personal anamnesis being the same as above, except that projectile vomiting has to be mentioned, which occurred daily during the last six months. At present he has paroxysmal headaches every few minutes, which are, at the time of the intended examination, so strong that it has to be postponed; the patient being practically unconscious, or at best semi-unconscious. The hemianopsia is progressive, with marked primary atrophy of the hemianoptic fields, and slight hyperæmia. The knee-jerk and foot clonus are exaggerated, especially on the right side. No sensory disturbances. Slight optic atrophy, more marked in the right eye. Exophthalmus of right eye, pupils react equally to light; no oculomotor disturbances. Heart normal. Diagnosis: tumor of the hypophysis reaching to the anterior angle of the chiasm of the optic nerves, with pressure on the same. I may be permitted to state that bitemporal hemianopsia means blindness of both nasal halves of the retina.

After due consideration of the case and a consultation with the father of the patient about the chances of a removal of the tumor, this operation was decided upon.

The way to reach the chiasm in an operation is rather unexplored; and, while I have made a number of experiments to this purpose, some further operations on the cadaver were considered necessary, and the operation on the patient was therefore postponed a few days. During the night of December 11–12, that is two days after admission, the entire clinical aspect of the case changed suddenly. The temperature, which had been normal before, rose to 104° F., and the patient's condition became semi-comatose. The right pupil was widely dilated, while the left presented the size of a pinhole. All four extremities were paralyzed to a certain extent. These symptoms indicated a perfora-

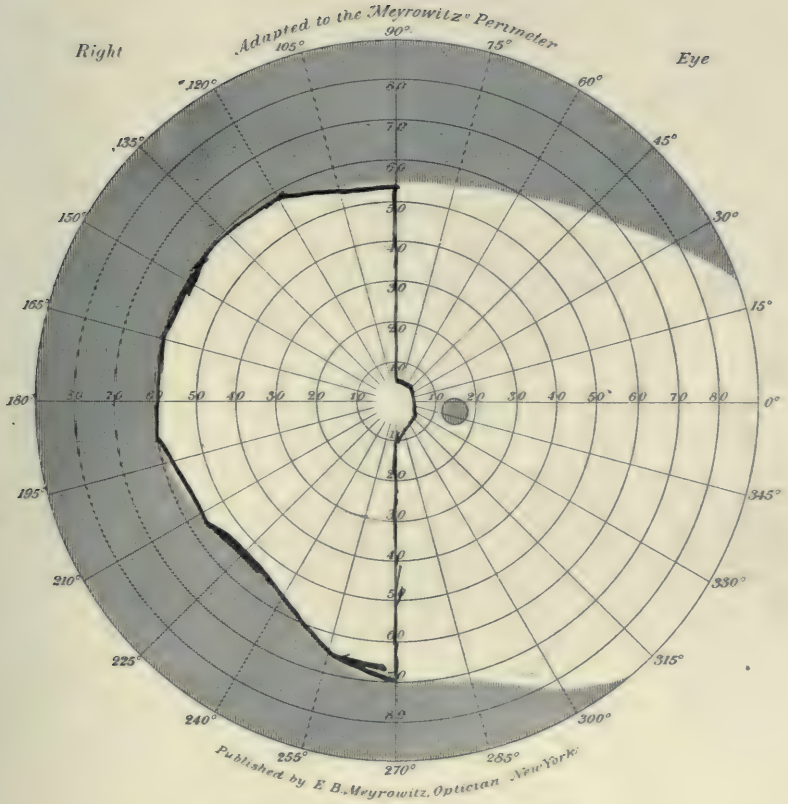


FIG. 1.—Perimetrical examination of right eye.

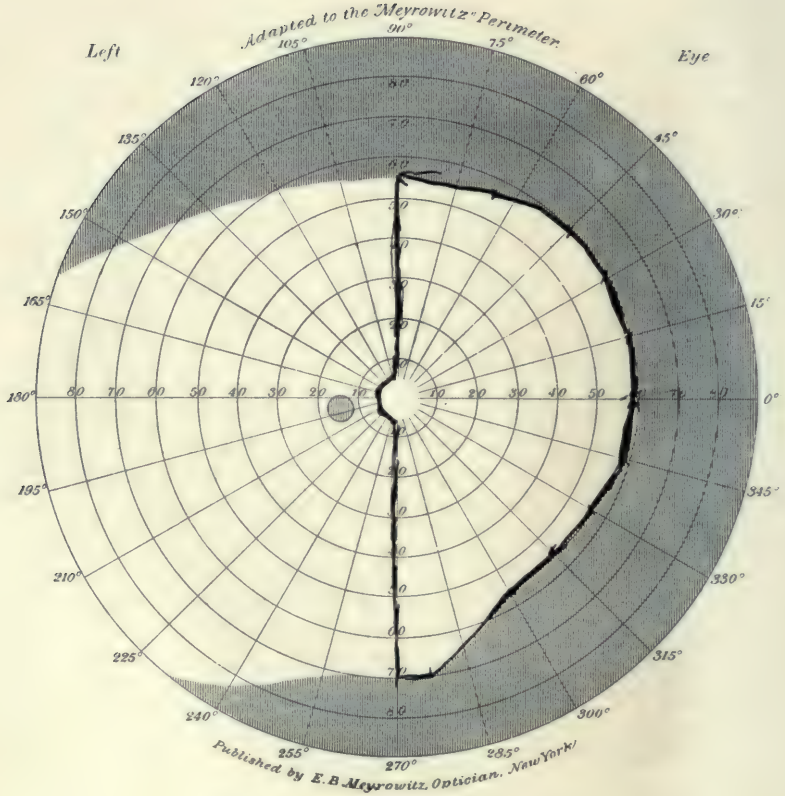


FIG. 2.—Perimetrical examination of left eye.

tion of the tumor, possibly cystic, into the lateral ventricle; eventually hæmorrhage into the same. For that reason an immediate operation was decided upon to relieve the pressure on the ventricle. The condition of the patient was so comatose that it was deemed possible to operate without narcosis; but shortly before the operation he revived so far that a slight chloroform anæsthesia became necessary.

Right side osteoplastic flap, after Wagner, was made with Sudek's fraise, with electric motor, to puncture the ventricle and to relieve pressure. The ventricle was struck without any difficulty, but only a few drops of serum appeared through the cannula. The patient's condition forbidding any further interference, none such was attempted. Replacement of the flap, dressing, patient put to bed. Temperature kept on rising, condition of the patient stayed the same till, eight hours after the operation, exitus took place.

Autopsy, by Dr. Schwyzer.—Cadaver of a moderately large boy, no œdemata, no atrophy. Skull shows small Wagner flap on the right side. Cranium not quite symmetrical, right occipital portion somewhat larger than left, bones remarkably thin; the dura tense, rather moist; vessels of the dura rather empty, sinus longitudinal, contains no blood; the lymphatic vessels appear to be imbibed with blood. Subdural space fairly moist, pia shows considerable arterial and venous injection. At the right side under the dura, corresponding to the parietal flap (which corresponds to the flap incision), is a plaque of coagulated blood of the thickness of several millimetres.

The corpus callosum, especially in its anterior portions, arches forward and appears quite resistant. After the brain has been removed, a round, dark tumor of the size of a plum is discovered in the region of the Chiasma opticorum. (Figs. 3 and 4.)

Both olfactory nerves apparently unchanged. The optical nerves appear to be spread and extend backward in a sagittal direction before converging.

To the right and left upon the cystic tumor protuberances like varices appear, which are filled with dark-colored blood, partly fluid, partly coagulated.

Puncture of the central portion of the tumor in the median line reveals a thick, bloody fluid containing many small, yellowish particles of tissue and fat crystals.

The tumor before incision was almost round, with a longitudinal diameter of about four to five centimetres; its anterior walls are quite thin.

The Sella turcica is remarkably deep, its posterior edge is corroded, quite sharp and projecting straight upward. The anterior edge also shows a distinct line of corrosion. The Sella turcica measures almost 3 centimetres in a sagittal direction, 3.5 centimetres across, and 1.5 centimetres in depth. The hypophysis cannot be found, so that the tumor must be looked upon as a tumor of the hypophysis. The portions of the tumor which lie in the lateral depressions of the Sella turcica, and the posterior parts of the tumor, contain grayish-red tissue, which, however, does not represent coagulated blood. The lateral sinuses contain fluid blood.

The left lateral ventricle contains a little clear fluid, the right a few drops of the same.

Addenda.—The tumor has a length of 4½ centimetres, a width of 2½ to 3 centimetres, and about an equal height. The olfactory nerves are not attacked, but the region of the Chiasma opticorum is involved. The veins at the base of the cranium (sinus cavernosus) are enormously dilated, and stretch in thick cords transversely above and below the tumor. The sinus intercavernosus anterior and posterior, especially, are transformed into wide canals. The tumor itself represents a cyst-like swelling filled with partly coagulated, partly half-fluid blood. In removing the brain, a small rip of the cyst occurs, from which soft, partly black, partly brown coagula and fluid blood are evacuated. In conjunction with these substances, soft gelatinous tissue of yellowish and brownish color are found, which represents the tissue of the cyst. The tumor is most firmly adherent to the Chiasma opticorum. An attempt to sever the tumor from the latter shows that the anterior branches of the chiasm are intact, while the posterior portions are wanting, *i.e.*, they seem to disappear in the cyst. No trace of the hypophysis can be found.

Microscopical examination of the cyst shows that the anterior portion of the tumor is practically one cyst, filled with blood; in the posterior portion it is solid tissue. The coagulated blood contains small particles of tissue, some of which possess the character of papillæ of cystadenoma. The wall of the cyst in its outer portions consists of fibrillary multinuclear connective tissue, while the inner layer is formed of small-celled tissue. The posterior

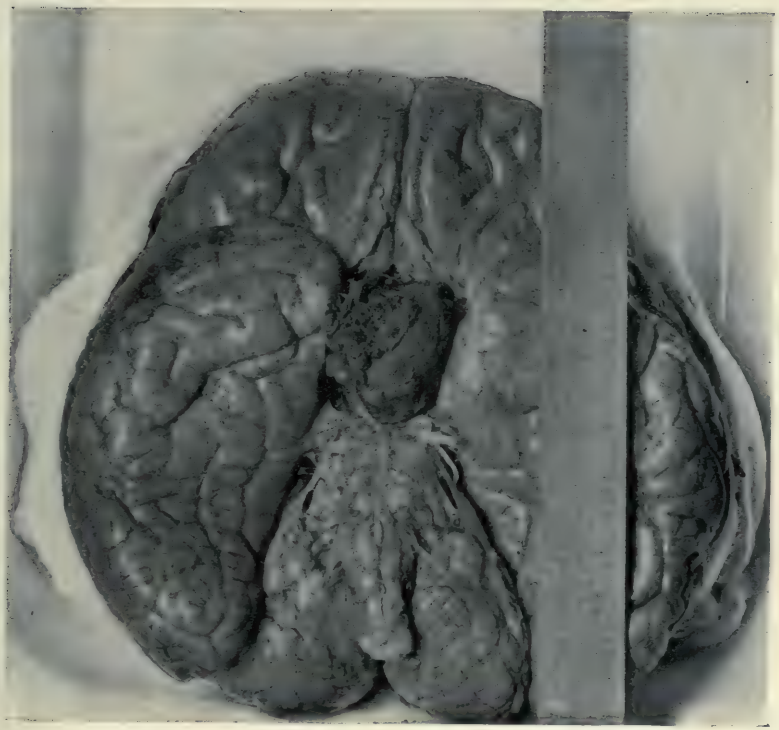


FIG. 3.—Base of brain showing tumor in situ.



FIG. 4.—Tumor dislodged and held to one side by a pin, showing course and condition of optic nerves.

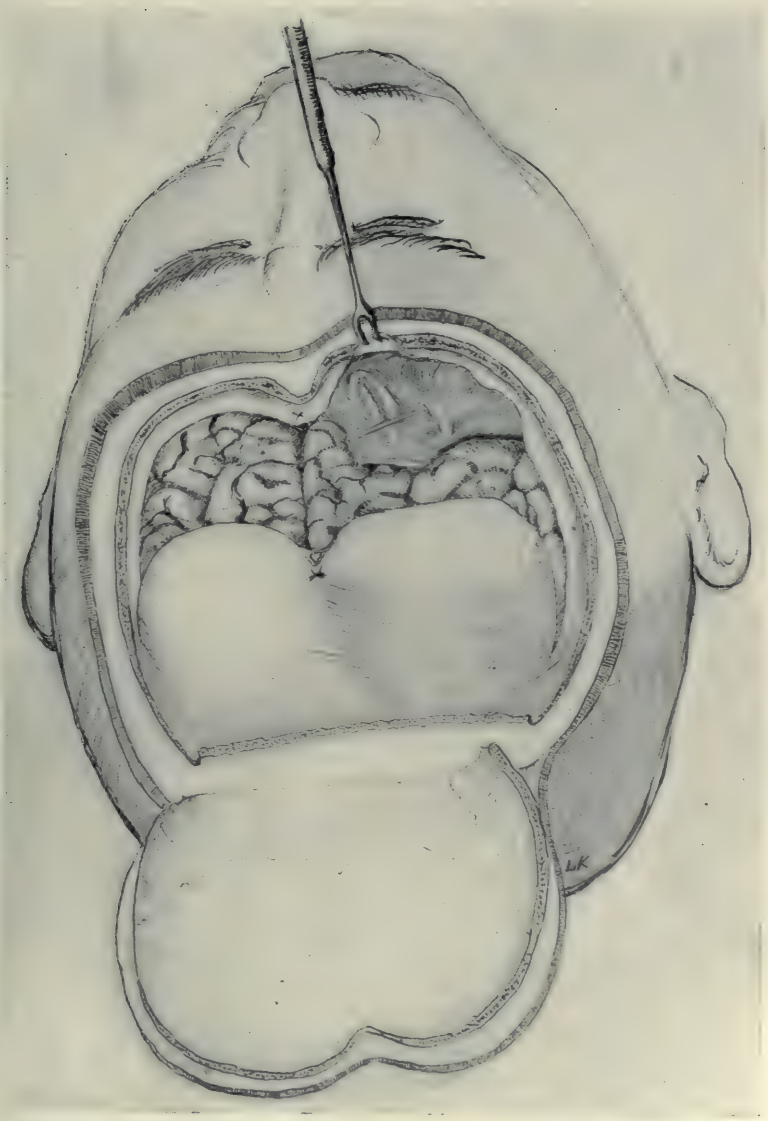


FIG. 5.—Proposed method of reaching tumors of the optic chiasm.

portions of the tumor show glandular tissue here and there, with cystic spaces filled with large colloid masses and with large epithelioid cells. Often the structure of a cystadenoma is clearly shown, but the adenoma-cells are relatively small. The stroma of the entire tumor consists partly of pigmentary cells; many parts of the posterior portion are more like connective tissue, with many blood-vessels and no glandular character, so that they might almost be looked upon as sarcomatous tissue.

Diagnosis.—Adenoma of the hypophysis with colloid degeneration resulting in compression of the basal venous system and partial destruction of both optic nerves. Finally, a hæmorrhage in the cysts of the tumor led to a rapid increase of volume with almost complete interruption of the optic nerves.

I may state right here that the rather unusual character of the tumor with its enormous vascularization would have forbidden absolutely any attempt to remove it, as a fatal hæmorrhage would have followed any such attempt most assuredly.

In looking through the literature, I found quite a large number of cases of tumors of the region of the chiasm. While I have not been able to follow all these cases, I have personally been able to trace forty-two, quite a large number of which are cases of acromegaly, the others being tumors of the pituitary body without any symptoms of that disease. It is therefore only natural to consider the possibility of reaching these tumors by operation, and I dare say that if most of these cases did not come under the observation of the nerve and eye specialists, as is natural, the idea of an operative interference would probably have been approached before; if such has been the case, I am not aware of it, at least I have not been able to find anything about it in the literature.

If the region of the chiasm can be reached at all for technical or anatomical reasons, the operation may be indicated either for purely symptomatic causes or for curative purposes. The presence of a tumor at the chiasm probably never makes itself manifest till pressure on the optic nerves ensues. Therefore an operation would in a certain way always have to be for

symptomatical reasons; this all the more as the tumors of the hypophysis have not the tendency to sarcomatous degeneration common to other parts of the brain. This is another reason which makes these operations appear desirable, as the final prognosis is decidedly better and more encouraging than with other parts of the brain, these tumors proving to be of a non-malignant character. The question of acromegaly and its possible treatment or cure by operation on the hypophysis is a matter rather difficult to discuss as long as the opinions about the etiology of that disease are so divided. If hypertrophy of the hypophysis is only one of the symptoms of acromegaly, like the hypertrophy of other extremities, operative interference for total or partial removal would not be indicated until the tumor exerts pressure on the chiasm. If, on the other hand, the disease, as such, was produced by the original hypertrophy of the pituitary body, an early operative interference might be of some avail.

The reason why tumors of this locality have so seldom been operated upon lies entirely in the difficulty of reaching them. The attempt to get at the chiasm by a temporal flap, lift up the temporal lobe of the brain, and work one's way along the pars petrosa of the temporal bone is frustrated by the extremely dense adherence of the dura to the bone. Even if we should succeed in reaching the anterior foramen lacerum between the canalus caroticus and foramen ovale, we would find ourselves behind the Sella turcica, in fact, behind the processus clinoidus posterior. Besides, a very large side flap would have to be made in order to lift up the brain high enough not to work entirely in the dark.

Several years ago I was impressed with the desirability of reaching the chiasm, and therefore tried the following modus: A modified operation after Kroenlein's method for reaching the rear parts of the orbita was considered feasible by combining it with a large frontal flap. The idea was then to break this large frontal flap downward in such a way that, after its detachment from the zygomatic process, it could be turned downward forward, bringing with it the entire upper

roof of the orbita. This operation having been done several times on the cadaver, it was attempted in a case where the diagnosis of tumor of the chiasm was made. The operation had to be discontinued, as it was impossible to break out the flap. The autopsy showed that an enormous sarcoma of the brain existed, with no symptoms except those produced by pressure on the chiasm, combined with a very extended osteosarcoma of the skull, which easily explained the impossibility of breaking out the flap. But I have convinced myself since then that any extra dural operation is without value in an attempt to reach the chiasm, as the same difficulties meet us here that we find in the operation with the side flap, namely, the dense attachment of the dura to the bone. Therefore intradural operations had to be decided upon for this purpose. Besides, there is another objection to this way of opening the skull, as many surgeons may be loth to break the roof of the orbita in the proposed fashion, as one cannot be reasonably sure how it is going to break, and even possible injury to some of the veins may result.

I therefore came to the conclusion that the only rational way of getting at the chiasm was in the following manner: A Wagner flap is formed on the frontal bones with true omega shape, the base of which lies about half an inch behind the sutura coronaria, the indentation of the omega comes to lie exactly in the median line, to avoid, if possible, the opening of the sinus frontalis. The dimensions of the bone flap thus formed are in the median line 5 inches, the lateral diameters being 5½ inches, the width 7 inches, and the base where it is broken off 3½ inches. The skin incision severs the temporal artery on both sides. The opening of the skull is made with a Sudek's fraise with electric motor beginning at the base of the flap, the fraise is then led on forward, following closely the line of the omega formed in such a manner that the distance of the horizontal branches from the orbital margin is three-quarters of an inch, then going upward to describe the indentation for the purpose of avoiding the sinus, thus reach-

ing a height of one and one-half inches from the root of the nose. The other half of the flap is symmetrical.

After a number of discouraging experiments, I have been able to bring the time for cutting the bone down to eight minutes.

The failures in my former experimental efforts were due entirely to the fraises not being sharp enough and too softly tempered. The electric motor is of one-quarter horse-power with the usual 120 voltage of the street current. I attach a great deal of importance to the quick work of the fraise, because the danger of forming such a large flap is decidedly lessened if there is less loss of blood by quick work. Any injury to the dura can easily be avoided if the instruments are well made, that is, if the protective knob of the fraise is perfectly smooth. After this a Gigli director is inserted from the starting to the finishing point, and the flap sawed through, or at least partially. After breaking the flap, the incision in the dura is made, following the line of the bone closely in the distance of half an inch up to the median line, where the sinus is left intact. The other half of the incision is symmetrical to the first. We now tie the longitudinal sinus, which is only a small vein at this place. The ligation is best made by first applying two clamps, between which the falx is cut through, and then the ligatures applied. The dura need not be dissected back any further, thus avoiding undue oozing. Now begins the work of the lifting up and out of the frontal lobe of the brain, which is done with two brain spoons. The frontal lobe can thus be shoved back without any trouble or hæmorrhage, till the optic nerve comes into view. The only disadvantageous thing liable to happen is the tearing off of the olfactory bulb of one side. I have used this method now repeatedly on the cadaver, and cannot find any objection to it, as far as one can judge from operations on the cadaver. (Fig. 5.)

The principal danger in most brain operations is, of course, hæmorrhage, but during the steps described it is almost inconceivable that a hæmorrhage of any importance can occur. Thus far I have only described how to reach the anatomical

point desired. What is then to be done depends on the character and size of the tumor to be found. The danger of hæmorrhage now to be encountered is especially from the intercavernous sinus. Cysts of the hypophysis, which are not at all infrequent, would of course lend themselves most easily to treatment by evacuation, while adenomata, if they are not too hard, will permit of a partial removal by the sharp spoon. Any hæmorrhage occurring now, I would try to stop by temporary tamponade, and finally by laying a thin piece of rubber tissue on the surface, and allowing the brain to drop back into place.

I am quite aware how awkward it must appear to recommend an operation which I have only been able to try on the cadaver. But these cases are, after all, not so frequent that one surgeon would see many of them. Therefore I bring this operation to the attention of surgeons.

PRIMARY CHOLECYSTECTOMY: SCOPE, METHOD, AND RESULTS.[1]

CONCLUSIONS FROM FORTY-TWO CASES IN THE PRACTICE OF THE AUTHOR.

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THE subject of gall-bladder surgery has become altogether too extensive to be considered in any paper of ordinary length. It will be best, therefore, to take one phase of the subject, even though it be but a small part of the whole, and, in viewing this from the stand-point of individual experience, we shall, perhaps, find interest and profit.

The following paper is based upon my own work in primary cholecystectomy gained from forty-two cases in which this operation was performed.

Courvoisier,[1] in an article on cholecystectomy in Kocher's "Encyclopædia of Surgery," states that the first extirpation of the human gall-bladder was performed on July 15, 1882, by Langenbuch. His example was soon followed by Courvoisier, Riedel, Thiriar, and Krönlien.

The operation as a primary procedure has for some reason not become popular. The indications for its performance as stated by various authors (Riedel,[2] Davis,[3] Kehr,[4] W. J. Mayo,[5] Courvoisier,[6] M. H. Richardson,[7] and others) embrace:

First. Serious injuries of the gall-bladder. Second. Grave diseases of the gall-bladder, such as suppuration, atrophy, and cancer. Third. Repeated or complicating gall-stone disease. Fourth. Obliteration of the cystic duct.

Practically, all agree that ulceration and gangrene are indications for the removal of the organ, but Ochsner[8] says:

[1] Read before the New York Surgical Society, March 9, 1904.

"It is not wise to operate during the acute stage of cholecystitis," an opinion not verified clinically by the writer.

Nearly all authors seem to regard cholecystectomy as a graver surgical procedure than cholecystotomy, and some seem to consider it even more serious than choledochotomy.

It is my conclusion that extirpation of the gall-bladder in non-cancerous cases is a very safe operation, and that it is far more satisfactory in suppurative, calculous, and atrophic conditions than cholecystostomy.

Riedel, in his recent monograph [9] on gall-stone disease, states that, because the extirpation of the gall-bladder requires an incision from thirty to thirty-five centimetres long, the operation cannot be compared with cholecystostomy performed in two stages. I fully agree that if we subject the patient to the terrible shock of a fifteen-inch abdominal wound, especially in septic or weak individuals, the mortality will be far greater than if a cholecystostomy is performed through a four-inch opening. If, however, we can with speed and comparative ease extirpate the organ through the smaller incision, thus completely eliminating a septic focus, and if at the same time we can assure ourselves by actual inspection and all other tests that the common duct is free, and if we can at once remove obstructing stones from the common duct either by incision or by manipulating the calculi out by way of the cystic, it seems to me that the choice of operation must be in favor of the more radical procedure.

Roughly speaking, the cases may be divided into two classes, viz., those in which active infection is present and those in which there is no active infection. If there is no active infection, the matter of drainage of the bile ducts becomes unimportant, and one may as well remove the diseased organ which once has shown a vicious tendency. Yet, even in the second class, when active infection is present, it seems also wise to remove the septic viscus, and, if necessary, drain the biliary system, provided the anatomical conditions are not such as to make prolonged and difficult manipulation necessary. If actual gangrene is left behind, it will continue to be

a serious menace, even though the gall-bladder is thoroughly drained; and, if this gangrene, though very extensive, does not involve the serous coat, one may perform cholecystostomy and never actually know that the gangrene exists.

When for any reason drainage of the biliary system seems desirable, it can be easily accomplished by means of a tube in the hepatic duct; but it seems reasonable enough that when the common duct is free the best drainage of all is the natural one through that structure into the intestine. The only exceptions to this are, first, the presence of septic cholangeitis, which is, in any event, probably the most serious of the biliary diseases. Here we may then divert the flow of infectious material directly to the outside of the body. And, second, when there is reason to suppose that fragments of calculi have slipped out of reach into the hepatic duct.

Richardson,[10] in discussing cholecystectomy, mentions three disadvantages:

First. That there is no possibility of draining the biliary passages except through one of the ducts, and that only after a difficult and unsatisfactory operation.

Second. That there is greater danger in the operation.

Third. That redrainage of the biliary passages is extremely difficult and dangerous.

As to the first of these alleged disadvantages, it seems to me that the drainage of the biliary passages by tube at one sitting with a cholecystectomy is far from difficult, and is extremely satisfactory.

As to the second objection, that of danger, I can but say that since I have performed cholecystectomy as a primary measure, my mortality rate in diseases of the biliary passages has fallen materially.

The third objection is perhaps valid, but I have never found it necessary to redrain.

The same writer states that he has never had occasion to suspect recurrence of gall-stones after cholecystostomy and drainage, and W. J. Mayo [11] has collected 2000 operations in the hands of six surgeons with no instance of re-formation of

calculi. It would be interesting to know whether in these 2000 cases there has been no recurrence of biliary colic, for it has seemed to me far from rare to hear of pain, in some instances quite severe, after almost any operation for gall-stones. To be sure, this pain has been variously explained as being due to adhesions, to mucus, etc.

It has been my observation that after cholecystostomy secondary operations have not infrequently been necessary, either on account of recurring infections or because of troublesome fistulæ. No secondary operation has been required in any of my patients who have been discharged after cholecystectomy.

My list comprises forty-two cases, counting only those in which the operation has been performed as a primary measure, not after other operative attempts at cure or palliation. The first operation was on May 15, 1900, and twenty-five were done since December 1, 1902. Of the total number, twenty-nine cases were operated upon during the progress of acute active infection and thirteen were in the chronic or latent stage of infection. In one instance belonging to the latter class the gall-bladder was removed, although apparently not diseased.

Of the total number there were ten males and thirty-two females. The youngest patient was a girl eleven years old, whose history has been elsewhere recorded,[12] and who had suffered for years from cholelithiasis. The oldest was a man of sixty-eight, with acute calculous cholecystitis and empyema of the gall-bladder.

A history of antecedent typhoid was obtained in eight cases (19 per cent.).

There was gangrene of the viscus, more or less extensive, in seven of the cases. Choledochotomy was performed six times together with cholecystectomy. Marked jaundice was present in fourteen of the patients. Drainage of the hepatic duct by tube was practised twice. There was a recurrence of pain resembling colic in six of the cases, but in only two did jaundice occur. One of these patients passed two stones after

the cholecystectomy, but her operation was performed before the elaboration of the method which I now employ.*

The most noteworthy postoperative complication has been a bronchopneumonia, usually on the right side. It was encountered five times.

There has been one death. It was due to streptococcus infection existing before the operation.

In my division at the Mount Sinai Hospital the usual procedure in cases of gall-bladder infection with or without calculi is extirpation, and since adopting this practice the percentage of deaths has steadily decreased. In short, I firmly believe that primary cholecystectomy in the majority of cases is safer than any other operation on the bile passages, even when complicated by jaundice or grave sepsis, and when such procedures as appendicectomy, choledochotomy, gastrorrhaphy, or duodenorrhaphy must be performed at the same time.

Up to the present writing the types of gall-bladder disease which are not considered suitable for cholecystectomy are the following:

First. Extensive carcinoma with involvement of neighboring viscera.

Second. Cholecystitis with large perforations and pericholecystic abscesses, so that on entering the abscess with the finger one at the same time enters the gall-bladder. But even here the procedure will depend upon the extent of the involvement and the condition of the patient.

Third. In cases of known hæmorrhagic tendency.

Fourth. In obviously moribund patients.

The advisability of the radical procedure during the actual progress of a typhoid fever would have to be considered after a review of the facts in the individual case. Even here gangrene would be an indication for cholecystectomy. The question has not yet arisen in any case since I began doing this work systematically.

* At the present date (June 22, 1904) this patient has had no pain for nearly a year.

The operation has been greatly simplified by the employment of an operating table with an enamelled iron piece about six inches wide, which may be raised or lowered by means of a crank so as to serve instead of a sandbag or pad under the patient's back. This device permits one to hyperextend the patient to any desired degree of lordosis. The gain in accessibility is really most remarkable.

The steps of cholecystectomy as performed by the writer are as follows:

First, an incision is made from two to four inches long running between the fibres of the upper portion of the right rectus muscle at about the junction of its inner and middle third. The posterior rectus sheath and peritoneum are now incised between mouse-tooth forceps and digital exploration is made. The gall-bladder having been located is drawn towards the external wound. If the viscus is very tense or is supposed to contain infectious fluid, it is isolated by gauze packings, and aspiration is performed in order to empty it as completely as possible. When the walls seem very friable, it is even wise to incise and empty the viscus, closing the opening by ligature or clamp before proceeding with the extirpation. The gall-bladder is usually quite a tough organ, and in the majority of cases it may be grasped with an ovarian ring-clamp applied near its fundus, which at the same time closes the aspiration puncture.

The patient is then placed in the proper position by raising the movable piece of the table for about six inches; gauze packings are laid over the neighboring viscera, and the parts are exposed with the help of blunt retractors. Traction upon the gall-bladder is continued, and an incision with scissors is made through its peritoneal covering at the fundus, about half an inch from its junction with the liver. One blade of the scissors is worked between the serous and fibrous coats of the viscus, and an incision parallel to its long axis is made first on its anterior and then on its posterior aspect. Usually some tough fibrous tissue has to be divided in order to free the fundus from the edge of the liver; then the viscus is further

freed with the finger, taking care not to lacerate hepatic tissue. Hæmorrhage is usually very slight and is easily controlled by packing. Near the cystic duct the connection between the gall-bladder and the liver again becomes more intimate, and it may be necessary to divide fibrous tissue with the scissors, controlling an occasional little spurter with artery clamps. During this entire procedure traction is made by means of the ovarian clamp. When the cystic duct is reached, it is caught with a clamp, the jaws of which are at a right angle with the handles. Now with a hæmostatic needle a traction suture of silk or chromicized catgut is passed directly through the cystic duct about one-quarter or one-third of an inch beyond the clamp (*i.e.*, between the clamp and the common duct). The ends of this suture are tied together, but the suture itself is left free, so that if desired it may be withdrawn after the operation. In order to be prepared for possible accidents, I usually put in two of these sutures. The gall-bladder is now ablated between the clamp and the traction sutures after protecting any visible viscera with gauze. An assistant now makes traction by means of the sutures, raising the cystic duct towards the external wound. If the cystic duct is patent, bile will probably flow and the cystic artery or arteries will spurt. If there is no bleeding, traction on the sutures should be released until the vessel spurts. It is then caught and ligated. This done, the rest of the operation may proceed at leisure.

The cystic duct being now freed from its fibrous connection with the liver, traction upon the sutures will bring the common and hepatic ducts into view, and if the cystic is patent, a large probe may easily be passed under guidance of the eye in either direction. If the cystic is not patent, it is not wise to trust to palpation in determining the presence or absence of calculi in the other ducts, but the cystic should be slit with scissors down even into the common duct, if necessary, or until there is a free flow of bile. In the absence of stones, a large-headed probe may now be passed into the duodenum. Large stones in the common duct may be removed through a prolongation of this slit, and stones from the hepatic

may be brought to the opening by manipulation, or may even be removed through a separate incision into the hepatic duct.

Being now perfectly certain that the passages are free, the incision, if there is one, into the common duct may be sutured, and the cystic, if not slit, may be ligated with chromicized catgut. The suture of the common duct may be so placed that the seam is at right angles to the long axis of the structure if there is any fear that a longitudinal seam might dangerously narrow the lumen. The seam in the stump of the cystic, however, should always run longitudinally, and the duct ligated as if it had not been sutured. It is my custom to leave the chromic gut ligature long, and not to remove the traction sutures, but to permit all the ends to emerge at the abdominal wound. I have rarely found it necessary to sew over the raw surface of the liver, and then only as a hæmostatic measure in persistent oozing.

It is now time to let down the table, and this should be done while the depths of the wound are thoroughly exposed, so that in the event of bleeding, on account of the release of tension as the patient comes into his more natural position, the points of hæmorrhage may be instantly seen and secured.

A slender cigarette drain is carried down to the stump of the cystic duct, and the peritoneum and fascial portions of the wound are closed with chromicized catgut sutures, the skin being approximated with sterile zince rubber plaster.

The shock following this operation is not usually severe, but an elevation of temperature for the following two days is to be expected. Vomiting is not often troublesome. There is frequently a considerable amount of biliary discharge from the raw surface of the liver, necessitating a change of superficial gauze in two or three days. The drain may be changed in from six to eight days and replaced by a small rubber tube for five or six days longer. The stump, if large, comes away in from ten days to two weeks or even longer; but if the cystic duct was not particularly thickened, its stump may never be seen, the ligature of chromicized gut coming away alone. As soon as the stump or ligature is out, a thick pad, made by

TABULAR STATEMENT OF CASES OF CHOLECYSTECTOMY.

Case Number.	Date.	Initials.	Age.	Male.	Female.	Stones present.	Acute.	Chronic.	Gangrene.	Jaundice.	With Choledochotomy.	With Drainage Ducts.	Recurrence of Pain.	History of Typhoid.	Postoperative Pneumonia.	Died.	Remarks.
1	May 15, 1900	M. N.	40	...	1	1	1	...	...	...	...	...	...	...	...	...	
2	Nov. 13, 1900	B. F.	35	...	1	1	1	...	...	...	...	...	.	1	...	...	
3	Feb. 16, 1901	J. S.	30	...	1	1	1	...	...	...	...	...	1	1	...	...	Attacks without jaundice. Postoperative hernia. Old technique. Now well.
4	May 7, 1901	J. K.	30	...	1	1	1	...	1	1	...	...	...	...	...	...	
5	July 23, 1901	X. L.	31	1	...	1	...	1	...	...	...	...	...	...	...	...	Postoperative abscess of stump. Slight hernia, but patient well.
6	Jan. 6, 1902	D. R.	50	1	...	1	...	1	...	...	...	...	...	...	...	...	Feels better than for years before operation.
7	Jan. 18, 1902	S. W.	30	...	1	1	1	...	...	...	...	...	...	..	...	...	
8	Jan. 25, 1902	A. K.	40	...	1	1	1	...	1	1	...	...	...	...	1	...	
9	Feb. 22, 1902	E. W.	11	...	1	1	...	1	...	...	...	..	1	...	...	...	Several attacks with jaundice, after operation. Well for the past year.
10	Mar. 4, 1902	H. S.	29	...	1	1	...	1	...	...	...	...	...	...	...	...	Continued good health.
11	Mar. 8, 1902	F. P.	28	...	1	...	1	...	...	...	...	...	...	...	...	...	Very thick-walled gall-bladder. Movable pancreas.
12	April 5, 1902	J. B.	32	...	1	1	1	...	...	...	...	...	...	...	...	...	Patient well in two weeks.
13	June 1902	M. L.	46	...	1	1	1	...	1	1	...	...	...	...	...	...	Uræmic coma twenty-four hours after operation. No suture of abdomen. Hernia, but well.
14	June 1902	S.	45	1	...	1	1	...	1	1	...	...	...	...	...	...	Postoperative stump abscess.
15	Nov. 1902	H. K.	31	..	1	1	...	1	...	...	...	..	...	...	...	...	Single large stone.
16	Oct. 25, 1902	S. S.	49	...	1	...	1	...	1	...	...	...	...	...	1	...	Right-sided pneumonia.
17	Nov. 8, 1902	A. S.	31	...	1	1	1	...	...	1	...	...	1	...	...	...	Recurrence of symptoms and passage of two large stones. Well now for nearly a year.
18	Dec. 2, 1902	D. F.	30	...	1	1	1	...	...	1	1	...	...	...	...	...	Complete rapid recovery. No leakage of bile.
19	Jan. 3, 1903	R. P.	46	...	1	1	1	...	...	1	...	...	...	...	...	...	Stone in cystic duct.

20	Jan. 13, 1903	J. K.	43	...	1	...	1	...	...	...	...	...	...	...	...	...	Empyema of gall-bladder. Appendicectomy for chronic appendicitis at same sitting.
21	Jan. 31, 1903	M. S.	12	1	...	...	1	...	...	...	...	...	...	1	...	...	Typhoid bacilli in fluid of gall-bladder, later in peritoneal fluid.
22	Feb. 26, 1903	J. A. U.	60	1	...	1	...	1	...	1	1	...	...	...	...	...	
23	Feb. 28, 1903	C. F.	29	...	1	1	...	1	...	1	1	1	1	1	...	...	Several attacks since operation. No stones passed. Appendix removed at same time.
24	Mar. 1, 1903	R. F.	32	...	1	1	1	...	...	...	...	...	...	...	...	...	
25	Mar. 17, 1903	A. S.	25	1	...	1	1	...	...	...	...	...	...	...	1	...	
26	April 21, 1903	S. G.	21	...	1	1	1	...	...	...	...	...	...	...	...	...	Appendicectomy at same sitting.
27	April 28, 1903	A. T.	68	1	...	1	1	...	...	...	...	...	...	...	1	...	Suppuration of wound, mild in character.
28	May 11, 1903	M. W.	34	...	1	1	..	1	...	...	1	...	1	...	..	...	Single attack without jaundice, three weeks after operation. Well ever since.
29	May 16, 1903	B. H.	58	...	1	1	1	...	1	...	...	...	...	...	...	...	
30	July 11, 1903	S. H.	35	1	...	1	1	...	...	...	...	...	...	1	...	...	Stump closed by suture, not ligature. Leakage. Peritonitis.
31	Sept. 30, 1903	U. D.	48	1	...	1	1	...	...	...	...	...	1	...	...	...	One attack of colic without jaundice.
32	Oct. 27, 1903	T. M.	34	...	1	...	...	1	...	...	...	...	...	...	...	...	Inflamed appendix removed at same time. Gall-bladder normal.
33	Nov. 3, 1903	S. R.	28	...	1	1	1	...	...	...	...	...	...	1	...	...	
34	Nov. 11, 1903	E. H.	19	...	1	1	1	...	...	1	...	...	...	...	...	...	
35	Nov. 16, 1903	A. S.	24	...	1	...	1	...	...	1	...	...	...	1	1	1	Streptococcus cholecystitis. Sepsis. Pregnant six months.
36	Dec. 4, 1903	R. B.	50	...	1	1	1	...	1	...	...	...	...	...	...	...	Pericholecystitic abscess. Streptococci in pus.
37	Jan. 2, 1904	K. G.	29	...	1	1	1	...	...	1	...	...	...	...	...	...	
38	Jan. 5, 1904	L. G.	44	...	1	1	...	1	...	1	1	...	...	...	...	...	
39	Jan. 9, 1904	A. R.	39	...	1	1	...	1	...	...	1	1	...	...	...	...	
40	Jan. 20, 1904	A. H. P.	35	...	1	1	1	...	1	1	...	...	...	...	...	...	Acetonæmia after operation.
41	Feb. 12, 1904	M. P.	35	1	...	...	...	1	...	...	...	...	...	...	...	...	Gall-bladder adherent to edges of large defect in duodenum. Duodenoplasty at same operation.
42	Feb. 20, 1904	I. E.	56	...	1	...	...	1	...	...	...	...	...	1	...	...	Stenosis of cystic duct.
	Totals.....			10	32	34	29	13	8	14	6	2	6	8	5	1	

wrapping a wide muslin roller with gauze, is bandaged firmly across the patient's abdomen below the sinus so as to press its walls together. Complete healing is accomplished in about four weeks, but has been secured in so short a time as fourteen days. The average time in the hospital is about three weeks.

The entire forty-two cases are here presented in tabular form, together with the histories of the last twenty-seven. The more interesting as well as all of the unsuccessful of the other cases have been published in other papers by the writer, and in the Mount Sinai Hospital Reports.

CASE XVI.—No. 73,239. *Suppurative Gangrenous Cholecystitis; Cholecystectomy; Cure.*

Mrs. S. S., forty-nine years old, was admitted October 24, 1902. Her past history, with the exception of what was called "nervous dyspepsia" accompanied by heartburn and belching, was negative. Two weeks before admission she began to have cramps, with considerable abdominal distention. The symptoms became more and more aggravated; there was severe epigastric pain radiating into the back, requiring morphine. There had been no vomiting but considerable belching. Urination had been normal; bowels constipated. The epigastric pain, in the beginning of a cramp-like character, became continuous. There never had been jaundice nor chills.

On admission her general condition was found to be fair, the tongue clean. There were a few râles at the left base. The patient was very obese.

In the region of the gall-bladder a tender mass could be easily felt; it seemed to reach to the level of the umbilicus; it had a rounded border and moved with respiration. The abdomen was fairly lax. The entire right side was tender to pressure.

On the day after admission, under chloroform anæsthesia, she was operated upon by the writer. An incision was made about four and one-half inches long between the fibres of the upper portion of the right rectus muscle. An enlarged gall-bladder presented, covered in front over its greater part by a considerably enlarged liver and surrounded by loosely adherent omentum and colon. On attempting to free the gall-bladder from its attach-

ment to the under surface of the liver, it suddenly burst, and considerable thick, purulent matter escaped. The viscus was now slit open and the mucosa wiped dry of pus and extirpation proceeded with. On account of the extraordinarily deep situation of the cystic duct, it was clamped and the instrument left *in situ*. The stump was cauterized with pure carbolic. Cigarette drain and partial layer suture of wound.

The gall-bladder, examined after its removal, was found to be greatly thickened; there were numerous ulcerations and points of gangrene, but no calculi.

A right-sided postoperative pneumonia somewhat delayed convalescence.

Five days after operation the clamp was removed and discharge of bile from the wound began. The biliary discharge ceased about November 15 and the patient was discharged well on December 3, thirty-nine days after operation.

CASE XVII.—No. 73,373. *Cholelithiasis; Common Duct Impacted Stone; Cholecystectomy; Recovery; Relapse.*

Mrs. A. S., aged thirty-one years, had had numerous attacks of typical gall-stone colic with jaundice. About six weeks before her admission on November 7, 1902, she had had an attack lasting from twelve to fourteen hours immediately followed by jaundice continued for fully two weeks. Two weeks before admission she had passed, following the attack, two gall-stones almost as large as marbles, and since then three others were passed. She was first seen by me in consultation with Dr. L. Stieglitz.

On admission to the hospital there was considerable jaundice. The general physical examination was negative and nothing was palpable.

Operation was performed under gas and ether on November 8. The liver was found somewhat enlarged, and, projecting from its under surface and adherent to the transverse colon and stomach by firm adhesions, was the distended and elongated gall-bladder. Two movable calculi, the size of small marbles, were distinctly felt within the common duct. These stones were forcibly dislodged into the gall-bladder, where they were secured. Cholecystectomy was now done in the usual manner, the ducts, however, being examined digitally, no probe being passed. The wound was closed by suture and strapping.

Her recovery was uneventful, and she left the hospital on December 5, about a month after the operation.

NOTE.—This patient has not remained well, but has had three or four attacks of typical biliary colic and has passed two more stones, the size of small marbles. That these stones were overlooked at the time of the operation seems hardly probable. It is not impossible, however, that this might have been the case, but the possibility of new stones having formed in the ducts cannot be excluded. This patient is the only one who has presented actual proof of recurrence of colic due to stones.

CASE XVIII.—No. 73,578. *Cholelithiasis; Common Duct Stone; Cholecystectomy; Choledochotomy with Suture; Recovery.*

Mrs. D. F., thirty years of age, had her first attack of jaundice shortly after her first confinement, about four years before admission. She was seen in consultation with Dr. Kalisher.

Her present illness had been of eight months' duration, beginning with pain in the back, repeated vomiting of whitish material, but neither chill nor fever. A few days after the onset she had become jaundiced. Since then she had had one or two attacks each week. The jaundice had increased and diminished, but the patient's skin had never been of a normal color. For the past four weeks she had been continuously and deeply jaundiced and had suffered from itching of the skin. There had been considerable loss of weight, twenty to twenty-five pounds.

On admission, the liver in the right hypochondriac region extended well below the level of the umbilicus and into the flank.

On December 2, 1902, under nitrous oxide and ether, a four-inch incision between the fibres of the right rectus was made, the incision beginning about two inches above and extending about two inches below the navel. A short second incision at right angles to the first was made at the level of the umbilicus backward. Cholecystectomy was performed in the usual manner. The entire gall-bladder was found densely packed with stones, and more stones were worked into it from the cystic duct. Exploration of the common duct disclosed a large stone close to the duodenum and very slightly movable. After considerable manipulation, the gall-bladder having been removed, the duodenum was rotated upon its longitudinal axis until the ampulla presented between the duodenum and stomach. This was incised close to the intestine. A large gall-stone was removed after it had been previously crushed with forceps, and a gush of bile at once followed. The

longitudinal opening in the duct was closed with five or six interrupted silk sutures, the seam being transverse. Small strips of gauze were placed on either side and over the line of suture. A cigarette drain was carried down to the stump of the gall-bladder and the greater part of the wound was closed by suture.

The gall-bladder was found to be about five inches long, with its walls somewhat thickened; its mucosa was also much thickened and trabeculated. It contained numerous large, facetted stones. The cystic duct was nearly one-half inch in diameter.

Recovery in this case was prompt, and the patient was discharged on January 12 entirely well. There had never been any leakage of bile.

NOTE.—She has remained well up to the present time and has gained over thirty pounds in weight.

CASE XIX.—No. 73,777. *Cholelithiasis; Stone in the Cystic Duct; Cholecystectomy; Recovery.*

R. P., forty-six years of age, was admitted on the 27th of December, 1902, with a history of biliary colic for about twenty-eight years, during which time she had had about fifteen attacks. They lasted usually for a few hours and were quite characteristic, icteric phenomena invariably following. The longest period of freedom was four and one-half years, but there had been a severe attack lasting two weeks about thirteen months before admission.

Her present history was of four weeks' duration. It began in the characteristic way, but deep jaundice came on and persisted. The liver was not palpable below the free border, but the region of the gall-bladder was very tender on pressure. There was some fulness in the right flank; the abdomen was tympanitic. Temperature was 99° F.; pulse, 90.

On January 3 cholecystectomy was performed. There were some omental adhesions to the fundus which had to be ligated. A stone in the cystic duct was milked back into the gall-bladder. The cystic duct was only about half an inch long and was much dilated. The common duct, also, was very short, and the stone was at the junction of the two. On removal, the gall-bladder was found to be very short, its mucosa injected and thickened. It contained about ten facetted stones the size of peas and numerous very small ones.

Five days afterwards the wound was dressed and the drain changed; the following day the drains were removed. On the

thirteenth day the chromic ligature came away, and on February 4 the patient was discharged recovered.

CASE XX.—No. 73,922. *Ulcerative Cholecystitis; Chronic Appendicitis; Cholecystectomy and Appendicectomy; Cure.*

Mrs. J. K., aged forty-three years, had had numerous attacks of what had been regarded as appendicitis. The first attack had been about eight years before, and the average duration was two days. She had suffered from colitis for many years; never had had typhoid fever.

The present illness had begun about six weeks before with attacks of abdominal pain, worse on the right side and shooting into the shoulders. There had been neither vomiting nor jaundice. The pain recurred from six to eight times a day.

On January 13, 1903, there was a sharp chill with a temperature of 104° F.; constipation, rapid pulse, and positive Meltzer's sign. There was distinct resistance with tenderness in the right hypochondrium. The writer saw the patient then in consultation with Dr. S. J. Meltzer and concurred in the diagnosis of appendicitis with probable cholecystitis. The patient at once entered the hospital, where an immediate operation was performed.

An incision along the border of the right rectus was first made, and an adherent, chronically inflamed, and much thickened appendix removed. A tense and distended gall-bladder, bound down by many firm and organized ahesions, was then found on palpation through the wound. The incision was enlarged upward, making it about four inches in all, and the gall-bladder, after the aspiration of about four ounces of turbid green fluid, was extirpated in the usual way. The gall-ducts were hastily explored, but no calculi were found. The cystic duct was ligated with heavy chromic gut, the stump carbolized, and the wound closed with drainage down to the stump.

The gall-bladder was of about eight ounces capacity; its mucosa was much congested; there were numerous ecchymotic spots and small ulcerations. No cause for the cholecystitis was found.

Recovery was prompt, the patient being discharged well on February 8. For some weeks after discharge this patient had occasional attacks of an anginoid type, the pain shooting down the right arm. Her physician, Dr. S. V. Haas, considered these attacks neurotic in character, and this opinion seemed to be con-

firmed, since they subsided completely under appropriate treatment.

CASE XXI.—No. 74,068. *Post-typhoid Cholecystitis in a Child; Cholecystectomy; Cure.*

M. S., a boy twelve years old, had been discharged from the hospital about three months before after a rather severe typhoid. For about six weeks he was well, and then he had occasional sharp attacks of epigastric cramps. There had been six attacks in all. Pain had been very severe, causing him to cry out and double up. The attacks lasted two or three days. Sometimes they were accompanied by vomiting, at other times not; they were not influenced by ingestion of food. There had been neither jaundice, fever, nor chills.

He was readmitted on January 31, 1903, with a liver palpable below the free border of the ribs and with an undefined, hard, rounded mass, very tender to palpation, in the region of the gall-bladder. There was considerable abdominal rigidity. The urine contained a trace of bile. His temperature on admission was 100.2° F., but it rapidly rose to 104° F., and operation was at once undertaken.

A two-inch incision through the fibres of the right rectus at its upper border exposed the edge of the liver, which almost hid an enlarged, tense gall-bladder. There were a few adhesions about the cystic duct. Aspiration yielded three ounces of fluid, at first clear and watery, then thick pus. The gall-bladder was removed in the usual way, but a slight tear with escape of fluid occurred near the cystic duct, which was then ligated close to the choledochus. The gall-bladder was four inches long; the mucosa much thickened and congested. There were no stones. The wound was closed with layer suture and cigarette drain to the stump.

A report on the fluid showed typhoid bacilli.

The patient reacted well, but on the following day the temperature rose to 101.4° F.; respiration, 36. There was a distinct yellowish color to the skin, which was dry. There was considerable abdominal rigidity.

The drain was removed, and it was found that leakage of bile had occurred, evidently through the accidental tear of the cystic duct, which had not been properly included in the ligature. The white blood count at this time was 30,000. On February 2,

forty-eight hours after cholecystectomy, the patient was once more anæsthetized, the wound reopened, adhesions freely broken up, and the space between colon and right kidney, which contained a considerable amount of purulent, bile-stained fluid, washed out. The wound was drained and packed. A culture of the fluid from the free peritoneal cavity showed the presence of typhoid bacilli.* The peritonitis gradually yielded, and on February 7 the ligature came away. On March 2 the patient was discharged well.

CASE XXII.—No. 74,301. *Cholecystitis; Cholelithiasis; Common Duct Stone; Cholecystectomy; Choledochotomy; Recovery.*

Mr. J. A. U., sixty years old, came to me on February 11, 1903. For ten years he had had attacks of "stomach trouble," paroxysms often coming on as frequently as once a week. He had never been jaundiced and vomited rarely.

The present attack had come on a month before, with jaundice gradually becoming more pronounced, until the icterus was as marked as I have ever seen it. There had been dull abdominal pain, never localized nor radiating. There had been neither vomiting nor headache, nor anything resembling biliary colic. He had lost considerable weight and strength. The diagnosis lay between carcinoma and chronic gall-stone obstruction.

On examination, a fairly firm, rounded mass, absolutely not tender, was made out about three fingers'-breadths below the right costal border. His physician, Dr. Manges, agreed with me that an exploratory operation was indicated, so Mr. U. was admitted to the hospital on February 24, 1903, and after careful preparation operation was undertaken on February 26.

Nitrous oxide and ether were the anæsthetics selected. The usual right rectus incision, about four inches in length, disclosed a contracted gall-bladder containing several stones and with many neighboring adhesions. The ducts were palpated and seemed to be empty. During this manipulation a small structure was found adherent to the common duct. It was at first considered to be a gland, but when removed it appeared as a hard, white, completely spherical mass about one-fourth inch in diameter. On section it had a thin, hard shell with pulpy contents. Dr. F. S. Mandle-

* Cultures in this case were made by Dr. E. P. Bernstein of the Pathological Department.

baum, Pathologist, reported it to be a degenerated and calcified epiploical appendage. The gall-bladder was now dissected out from the liver, rupture of the organ occurring during the procedure. The bile was sponged away, and eight rounded yet slightly facetted stones, each one-fourth to one-half inch in diameter, were removed. The bile began to flow so profusely that a temporary ligature was passed around the cystic duct to control it. The common duct was considerably thickened, so that palpation was not quite satisfactory, and accordingly two silk guide sutures were passed through this structure and the duct incised in its long axis. The probe passed readily into the duodenum. The duct was now sutured with silk, so that the seam ran transversely to the long axis. Evisceration of the mucosa of the gall-bladder was now attempted, but so much hæmorrhage was encountered that complete extirpation was considered safer, and was accordingly performed. The coats were tremendously thickened; the mucosa was very succulent and vascular. The wound was sutured, except the skin, which was closed by strapping, and the usual drain was carried down to the cystic duct.

At my first visit the following day I found my patient reading the newspaper. His recovery was ideal, and there never was the slightest leakage while he was in the hospital, but a sinus persisted long after his discharge, which took place on March 23. It finally closed, however, after a sudden profuse discharge of bile, and the patient has remained in perfect health.

Case XXIII.—No. 74,327. *Cholecystitis; Cholelithiasis; Chronic Appendicitis; Cholecystectomy; Choledochotomy with Drainage; Appendicectomy; Recovery.*

Mrs. C. F., aged twenty-nine years, patient of Dr. M. Rosenthal, had had typhoid when she was twelve years old. For the four years before her admission to the hospital on February 27, 1903, she had had frequent attacks of typical biliary colic with pain, jaundice, fever, chills, vomiting, clay-colored stools, and dark urine. Two gall-stones had been passed with stool seven months before. The jaundice had never been persistent, and was most marked after a severe attack of pain. For the ten months previous to admission she had had attacks at very frequent intervals. She had lost twelve pounds in weight; her appetite had been poor; bowels constipated.

On examination her general condition was fair; tongue moist

and clean; slight subconjunctival icterus. The liver percussed one finger's-breadth below the costal border in the mammary line, otherwise it did not seem to be enlarged and was not palpable. No mass could be felt.

On February 28, under gas and ether anæsthesia, I operated through an incision two and one-half inches long between the fibres of the upper part of the right rectus. A small gall-bladder with very much dilated but short cystic duct was removed. It contained thick bile, some of which escaped on account of the tearing out of the clamp which held the viscus. The common duct was secured by two silk traction sutures and longitudinally incised for about half an inch below the junction of the cystic. A soft, pigmented stone was removed in fragments from the common duct, and a large-headed probe was then passed on into the duodenum. A tube was pushed into the common duct and was held in place by sutures passing through the duct, but not through the tube. This tube was inserted about one inch towards the liver into the hepatic duct.

The appendix had been previously found and marked with a ligature, which was left in the wound. It was now again drawn into the wound and appendicectomy performed. The wound was closed by suture and adhesive plaster, the tube in the duct being left long, so as to drain outside of the dressings.

The serosa of the gall-bladder was found much thickened; the mucosa pale and thick. The total length of the organ was about three inches. The appendix was five and one-half inches long, its lumen for the proximal, three and one-half inches, being obliterated, and its last two inches being represented by a tapering fibrous cord.

The tube was removed from the duct on March 6, and on the 25th the discharge ceased. Patient left the hospital on March 27, four weeks after the operation.

NOTE.—She has had several attacks of biliary disturbance with jaundice since the operation, and I have advised her to submit to another operation if a thorough trial of medical treatment should fail. Possibly an erosion due to the presence of the drainage tube resulted in a cicatricial stricture of the hepatic duct, and it is not unlikely that with the atrophy of the cicatrix the patient may be relieved. At any rate, the cholecystectomy can in no sense be blamed for the recurrence of symptoms, for a choledochotomy was in any event indicated.

CASE XXIV.—No. 74,343. *Acute Cholecystitis; Cholelithiasis; Cholecystectomy; Recovery.*

Mrs. R. F., thirty-two years old, a patient of Dr. M. Schiller, had suffered from a typical attack of gall-colic three months before. The pain had been severe and was accompanied by vomiting and diarrhœa. Jaundice had appeared on the second day and had continued for forty-eight hours. About six weeks later she had had a similar attack lasting only one day, and not accompanied by jaundice. There was another slight attack in two weeks, and then on February 25 the most severe attack of all had begun. Every motion was painful. The patient was very constipated and vomiting was frequent. There had been chills and fever, the temperature rising to 105° F.

On examination a tender point was found in the right iliac region, but rigidity was most marked over the upper right rectus. No tumor was felt, the patient having a thick panniculus, and being difficult to examine. There was no jaundice.

The writer advised operation, which was accepted, and the patient entered the hospital on March 1, 1903. Under nitrous oxide and ether anæsthesia an incision about five inches long between the fibres of the right rectus was made. The gall-bladder was very deeply situated; it was congested and thickened, but there were no adhesions. The viscus was very tense. About three ounces of bile and pus were aspirated in order to relieve tension, and the gall-bladder was then easily peeled away from the liver. The viscus was now removed, the cystic duct being ligated separately, and the ducts thoroughly explored. Numerous small cholesterin stones were found in the gall-bladder, which had contracted until it was only about three inches long, although it was very much larger when distended. Its walls were very thick; the mucosa congested and trabeculated, but there were no ulcerations nor gangrene.

On March 6 the drain was removed and a tube inserted. Recovery was ideal, the patient being discharged well on March 22, three weeks after operation.

NOTE.—The patient has remained free from biliary disease.

CASE XXV.—*Cholecystitis; Cholelithiasis; Cholecystectomy; Recovery.*

A. S., twenty-five years old, was admitted on the 14th of March, 1903, with a history of attacks of biliary colic dating from

three months before. The diagnosis of cholelithiasis had been made, but in spite of careful search no stones had ever been discovered in the stools.

The attack for which he sought relief on admission had been of seven days' duration, coming on immediately after a light meal, with cramp-like epigastric pains radiating towards the lower right costal border. There had been vomiting, but neither chill nor fever. Constipation, but no jaundice.

When I first saw him his general physical condition was good; temperature 100° F.; pulse not accelerated. There was rigidity of the upper part of the right rectus with tenderness on percussion. The liver was palpable one finger's-breadth below the ribs.

On March 17, under ether anæsthesia, cholecystectomy was performed through a four-inch incision through its rectus. The gall-bladder was readily dissected from its peritoneal hepatic attachment. It was very tense, fully six inches in length, and its walls were much thickened. A large calculus was felt in the cystic duct and forced back into the gall-bladder. After digital exploration of the hepatic and common ducts, the cystic was ligated, the gall-bladder cut away, and the stump carbolized. The wound was closed by suture of deeper tissues and strapping of the skin, a small cigarette drain being carried down to the stump.

On opening the gall-bladder it was noted that the mucosa was covered with many small ulcers, and that the viscus contained eight calculi from one-quarter to two-thirds of an inch in diameter, as well as a multitude of small ones. On March 21 the wound was dressed and the drain replaced by a small tube. There had been a slight bronchopneumonia from which the patient was convalescent. On April 4 he was out of bed, and on the 8th, twenty-two days after operation, he left the hospital, the wound entirely healed. He remains perfectly well at the present writing.

Case XXVI.—No. 74,786. *Cholelithiasis; Appendicitis; Cholecystectomy; Appendicectomy; Recovery.*

S. G., twenty-one years old, was admitted April 19, 1903. She had been discharged from this hospital two weeks before, the diagnosis of cholecystitis having been made and operation having been refused. The biliary colic and fever having returned, she again sought relief, this time accepting operation.

On admission her temperature was 101° F.; pulse, 112.

There was acute tenderness in the region of the gall-bladder, but no mass was palpable, in spite of the fact that her abdomen was lax. Considerable tenderness in the right iliac region made the diagnosis of appendicitis also probable.

On April 21, under nitrous oxide and ether followed by chloroform, I performed cholecystectomy by the usual method. The case was a very simple one, and it is not necessary to go into it in detail. The common duct was free. A separate incision through the right rectus in the iliac region was now made and the appendix removed.

The gall-bladder was five inches long; its walls not particularly thickened. It contained forty-three facetted stones of various sizes. The appendix showed evidences of chronic inflammation.

Four days after the operation the small drain was removed and replaced by gauze. The patient was discharged well on the 13th of May, twenty-two days after operation.

Case XXVII.—No. 74,844. *Acute Ulcerative Cholecystitis; Cholelithiasis; Cholecystectomy; Recovery.*

A. T., aged sixty-eight years, came to the hospital on the 25th of April, 1903. His past history bore no direct relation to his disease, which had begun three days before with lancinating pain in the lower right chest, much increased by the motions of respiration. There had been no cough and no chill, but some fever. Considerable nausea. There was constipation, but no jaundice.

His general condition was quite good, but there was some pulmonary emphysema. There was great tenderness over the entire right upper quadrant of the abdomen. The free border of the liver could be distinctly palpated at the level of the umbilicus and the gall-bladder quite well made out. Rigidity of the right upper quadrant was marked.

This patient was considerably prostrated; his temperature being 103.6° F.; pulse, 120; respirations, 32. Although there was marked tympanites, it was not considered that signs of peritonitis were present.

After three days of general treatment operation was undertaken in chloroform anæsthesia. An incision four inches in length was made in the usual location; the liver was found within two inches of the umbilicus, congested and "nutmeg" in appearance. The gall-bladder was large, apparently thickened;

the cystic duct very much dilated and containing a large calculus. Firm adhesions to the colon and gastrohepatic omentum caused considerable technical difficulty, nearly all of the adhesions requiring ligation. The anæsthesia had been accompanied by considerable cyanosis and the operation had to be hurried. The gall-bladder was removed after ligation of the cystic duct. It was four inches long; its walls near the cystic duct being fully half an inch thick, while near the fundus they were only one-eighth of an inch in thickness. The mucosa was thickened, trabeculated, and near the duct there was a superficial ulceration. Many fragments of a large, soft stone, and innumerable small, brownish-yellow stones, together with several ounces of dark, viscid fluid, almost fæcal in appearance, were contained within the viscus.

Recovery in this case was quite slow on account of an intercurrent pneumonia and some suppuration in the depths of the wound. He was, however, discharged entirely well on June 10.

Case XXVIII.—No. 75,405. *Cholecystitis; Stones in Common Duct and in Gall-bladder; Cholecystectomy; Choledochotomy.*

This patient, Mrs. A. W., was sent to me by Dr. Henry Heiman on April 19, 1903, with a history of typical attacks of biliary colic followed by jaundice, extending over a considerable number of years. She was thirty-four years old, well nourished but not obese, and in excellent general condition. Examination was absolutely negative, and operation was advised solely on the evidence of the history.

On May 10 she entered the hospital and was operated upon the following day. A three-inch incision between the fibres of the right rectus revealed a shrunken, firmly adherent gall-bladder with many stones. The organ was divided into two chambers by a firm cicatricial septum or stricture. The fundus was filled with mucopus, but contained no stones. The other chamber of the organ contained numerous facetted stones, and on palpation a very much dilated common duct, containing many small calculi, was made out. The gall-bladder was removed in the usual way. Two retracting sutures were passed into the common duct and an incision was made between them. There was a free discharge of bile and six stones were removed from the duct, one of which had to be crushed and extracted in fragments. A probe was now passed into the hepatic duct and down into the duodenum. The

common duct was sutured with chromic catgut, so that the seam ran transversely, and the stump of the cystic ligated. The gall-bladder near its fundus had been so intimately connected with the liver that parts of the mucous membrane were left, and these were now destroyed with the actual cautery. Peritoneum and fascia were closed by suture and the skin strapped, the retracting sutures in the common duct being left long.

The gall-bladder proved to be one and one-half inches long, of an hour-glass shape, its walls very thick and friable. There were no ulcerations, but the mucosa was thickened and œdematous. There were twenty-four small, irregular gall-stones.

On May 20, nine days after operation, the wound was found healed with the exception of the drainage opening. On the 31st of May the patient was discharged with a small sinus, which closed a few days afterwards.

NOTE.—In spite of the thoroughness of this operation, the patient had a severe attack of colic about ten days after her discharge. There was no jaundice, however, and Dr. Heiman reports that there has been no other attack, the patient remaining in perfect health.

CASE XXIX.—No. 75,058. *Cholecystitis; Cholelithiasis; Cholecystectomy; Recovery.*

B. H., fifty-eight years old, was admitted on the 16th of May, 1903. For thirty-three years there had been attacks of biliary colic with occasional jaundice, but neither chills, fever, nor vomiting. She had had rheumatism, but not typhoid. For two weeks before admission there had been nausea, with sensations of pressure in the epigastrium, culminating in an attack of colic. The pain recurred, and fever, with a temperature of 102° F., supervened.

On admission a very large mass could be palpated in the region of the gall-bladder, which was extremely tender and firmly elastic. Her temperature was 103° F.; pulse, 90.

Immediate operation was performed through a four-inch right rectus incision curving slightly inward in its upper portion. There were no adhesions, but the gall-bladder was found, the size of an orange, very much distended and extremely tense. Eight ounces of greenish biliary fluid mixed with pus were withdrawn by aspiration. The gall-bladder was now packed off, its fundus incised and a number of medium-sized tetrahedral stones were

removed. The cystic duct was S-shaped, very much dilated, and its walls were soft and succulent. It contained a number of stones. The common duct was very short and very wide. A clamp was applied to the cystic, a ligature placed below, and the gall-bladder cut away. A double-barrelled lumen was noted on examining the stump, further examination showing that this was due to the peculiar curve of the cystic duct. Careful exploration rendered it certain that the common duct had not been implicated in the ligature. The mucous membrane was carbolized and the wound closed with drainage to the stump.

The walls of the gall-bladder were not much thickened, but there were numerous spots of gangrene in the mucosa. The pathological report on the fluid taken from the gall-bladder was negative. (Examined by Dr. Bernstein.)

Convalescence was absolutely uneventful, and the patient was discharged on June 10.

Case XXX.—No. 75,527. *Cholelithiasis; Cholecystectomy; Recovery.*

S. H., thirty-five years old, was seen by the writer for Dr. I. Strauss early in July, 1903. He had had typhoid fever when he was about thirteen years old and a severe attack of acute articular rheumatism in May, 1900. Seven months before his readmission on July 8 there had been a typical attack of biliary colic without jaundice, the attack continuing for three or four days. Four months later there had been a more severe attack accompanied by jaundice, clay-colored stools, and dark urine. The patient said that he had noticed "sand" in his movements. There had been a succession of colicky attacks for three weeks.

When first seen, in spite of the fact that the patient was quite corpulent, an extremely sensitive distended gall-bladder could be plainly palpated. Temperature about 100° F.; pulse, 84.

On the 11th of July cholecystectomy was performed through a four-inch incision. About twenty stones were milked from the common duct into the gall-bladder. After its removal, the viscus was found to be four inches long and of considerable bulk. The walls were markedly thickened. In addition to a number of smaller stones, one the size of a walnut was found.

In this case no ligature was placed around the cystic duct, but it was closed off by catgut sutures placed so as to bring the serous surfaces together. The wound was closed with drainage to the stump.

Two days after operation the temperature shot up to $104^{1}/_{5}°$ F.; pulse, 140, with occasional vomiting. The dressing was stained with bile and the lower part of the abdomen somewhat swollen and tense. A bile peritonitis was evidently present and a rubber drainage tube was inserted.

Two days later the temperature had fallen to 101° F. and the pulse to 100; there was considerable seropurulent, bile-stained discharge. The patient then made a good recovery, and was discharged on August 22.

CASE XXXI.—No. 76,346. *Cholelithiasis; Cholecystitis; Cholecystectomy; Recovery.*

U. D., forty-eight years old, a patient of Dr. Bodenheimer, had had frequent attacks of biliary colic. He had been suffering from indigestion and flatulence, but had never been jaundiced. There was no history of typhoid. For a few days before admission he had had very frequent attacks of biliary colic, and a minute gall-stone had been discovered in the stools on careful straining through gauze. His general condition was excellent, with the exception of a nervous disorder characterized by tremor.

Cholecystectomy was performed on September 30, 1903, under gas and ether anæsthesia. In order to make sure of the patency of the cystic duct, of which there was some doubt, the gall-bladder was slit down to this structure and it was thoroughly explored. Numerous small stones and considerable dark green fluid were found. The cystic duct was tied off with chromic catgut and the wound closed with drainage to the stump.

The gall-bladder was but slightly enlarged; its mucous membrane was considerably injected and thickened. It was filled with an enormous number of small, irregular calculi. The pathologist's report on cultures from the gall-bladder contents showed the presence of an actively motile bacillus negative to Gram, but not identified. (E. Libman, Assistant Pathologist.)

Healing was uneventful, the ligature coming away ten days after operation. Twenty-five days after operation the patient was discharged well.

CASE XXXII.—No. 76,534. *Subacute Appendicitis; Cholecystectomy; Appendicectomy.*

T. M., thirty-four years old, was admitted on the 21st of October, 1903. She was single and a domestic.

Her past history threw no light upon the illness for which

she had come to the hospital. This trouble began on October 13, with persistent vomiting and pain in the epigastrium and back. With slight intermissions the pain and vomiting continued until admission. Her temperature had been just over 100° F. There had been neither chills, sweating, nor jaundice. She was sent in by Dr. L. Stieglitz, with a diagnosis of appendicitis. On admission the abdomen was lax, all colic had disappeared, and there was absolutely no tenderness anywhere. There was a trace of bile in the urine.

On October 27 cholecystectomy was performed through a one and one-half inch incision between the fibres of the rectus. The liver presented and the gall-bladder was readily delivered. It was small and apparently normal, as were also the ducts. Cholecystectomy was easily performed, and the wound closed with a small drain to the stump.

This operation was decided upon at the time of the exploratory laparotomy mainly on account of the history and because the patient had stated that her mother had suffered for many years from gall-stones. The writer, not being satisfied that the symptoms had been due to trouble with the gall-bladder, made another one and one-half inch incision over the region of the appendix, and, much to his chagrin, found a well-marked chronic appendicitis with adhesions between the tip of the appendix and the cæcum of such a nature as constituted a typical jug-handle appendix. The organ was removed, the stump cauterized with pure carbolic, and the opening into the cæcum, where the tip of the appendix had been adherent, was closed by suture.

Recovery was uneventful, and the patient was discharged on November 10.

Case XXXIII.—No. 76,558. *Cholecystitis; Cholelithiasis; Cholecystectomy; Recovery.*

S. R., aged twenty-eight years, was admitted on the 2d of November, 1903. She had had typhoid fever thirteen years before. Otherwise her previous history was negative. The present history had been of nine months' duration, attacks of colicky pain in the right hypochondrium having become more and more frequent, until for a few weeks before admission they had occurred every five or six days. Pain had been exceedingly severe, radiating towards the back, accompanied by nausea and vomiting, with chilly sensations, and followed by weakness and profuse perspira-

tion. There had been no jaundice. The last attack, one week before admission, had continued for twenty-four hours.

Her general condition was good, the skin having a slight, general icteroid hue. The liver was somewhat enlarged, and pressure over any part of this organ caused pain in the region of the gall-bladder, which was distinctly palpable, projecting below the edge of the liver and quite superficial. The temperature was 99° F.; pulse rate, 72.

On November 3, under nitrous oxide and ether anæsthesia, I operated through a two-inch incision in the right hypochondrium between the fibres of the rectus. The enlarged liver and somewhat dilated gall-bladder presented. It was necessary to break up or ligate a moderate number of adhesions. The cystic duct having been exposed, retraction sutures were passed through its walls and the gall-bladder cut away. The cystic artery was secured by separate ligature. The ducts were explored with a probe. The cystic duct was then ligated, the stump carbolized, and the wound closed with drainage by the cigarette method.

The very much thickened gall-bladder contained about two ounces of mucoid material and thirty-four calculi, varying in size from sand to a small marble. The mucosa showed old hæmorrhagic spots.

On November 8, after a smart reaction, the temperature rising to 103° F. and the pulse to 108, the first dressing was done. Primary union was noted, and the drain replaced by a very small tube. On the 22d of November, nineteen days after operation, the patient was discharged recovered.

Case XXXIV.—No. 73,246. *Cholelithiasis; Cholecystectomy; Recovery.*

E. H., single, nineteen years old, was admitted to the medical service on October 26, 1902, having been sick for ten days. Her illness was characterized by frequent attacks of cramp-like epigastric pain uninfluenced by eating. There had been rather frequent vomiting, at first of food, then of watery, bile-stained fluid. There had been neither fever nor chills.

On examination she was noted to be slightly icteric. There was considerable tenderness in the epigastrium, especially in the median line, about two inches above the umbilicus. The blood count showed 9000 leucocytes and a normal number of red blood-cells. The liver was palpable, and there was some tenderness on percussion over the region of the gall-bladder.

On November 2 there was an attack of gall-stone colic, the blood and urine containing bile, and the stools being clay colored.

On November 11 she was transferred to the second surgical division for operation. Temperature at this time was 99½° F.; pulse, 82; respirations, 20. Operation was performed in gas and ether anæsthesia followed by chloroform, the usual technique being employed. Incision was two inches long. The omentum was firmly adherent to the entire lower surface of the gall-bladder and had to be freed from it by chain ligatures and section.

The gall-bladder was sausage-shaped, its walls very much thickened, and it contained ulcerations at the fundus. There were one large stone and seventy-nine small facetted ones. Wound was closed with drainage to the stump.

Six days after operation the first dressing was done, the drain removed and replaced by a small tube. The following day the temperature rose to 102.6° F., due to slight suppuration. The ligature and stump came away on the thirteenth day. Suppuration occurred beneath the aponeurosis, and a small counter-incision had to be made on December 20, after which recovery was rapid, and the patient was discharged cured on the 3d of January.

Case XXXV.—No. 76,767. *Post-typhoid Streptococcus Suppurative Cholecystitis; Pregnancy; Cholecystectomy; Death.*

A. S., twenty-four years old, married, was admitted on November 15, 1903. She had had typhoid fever, for which she had been treated at this hospital in the fall of 1902 and the spring of 1903. During this time there had been evidences of typhoid cholecystitis.

Her present illness had begun about three weeks before admission, with severe pain in the right hypochondrium radiating to the back. The pain recurred in paroxysms, and she had vomited frequently. There had been jaundice since the outset. Bowels had been moved by cathartics.

On admission her general condition was poor; temperature, 97.4° F.; pulse, 92. She was pregnant, the uterus extending well above the umbilicus.

On November 16 cholecystectomy through a four and one-half inch incision was performed in nitrous oxide gas and ether anæsthesia, for acute empyema of the gall-bladder.

On opening the peritoneum the gall-bladder was found surrounded by several adhesions, which were easily peeled off without

ligature. The gall-bladder, however, was very firmly adherent to the under surface of the liver and had to be cut away with scissors. During the manipulation, a rent was made through its wall and about three ounces of yellow, foul-smelling pus evacuated. The operation was then completed in the usual manner.

The gall-bladder after its removal was found to be three inches long and its walls considerably thickened. There were no ulcerations. The peritoneum was congested; there were no stones.

A culture from the pus, reported upon by Dr. Libman of the pathological laboratory, showed the presence of streptococci.

The patient did fairly well for the first twenty-four hours. Examination of the blood gave Widal reaction one to twenty. Neither the bile nor the urine reacted to the Widal test. (Libman.)

About the third day after the operation it became evident that the sepsis had not been checked, and from this time on there was a hard fight against the general streptococcæmia with pneumonia, and many of the other complications of this dreadful disease. The blood culture, which was taken on the 30th of November, was, however, negative.

After a terrible struggle with temperatures running from 97° F. to 106° F., often in less than twenty-four hours, the patient succumbed on December 8, twenty-three days after the operation.

A wound examination by Dr. Bernstein sixteen hours after death showed hypostatic congestion of the lungs with miliary abscesses; the heart fatty and anæmic; the spleen septic; and the kidneys showing parenchymatous degeneration. An abscess, the size of a walnut, well closed off from the general peritoneal cavity, was found connecting with the lower angle of the wound. The liver showed perihepatitis. Between the under surface of the left lobe and the upper surface of the stomach was a large abscess containing about four ounces of pus. The liver parenchyma was pale and acutely degenerated. On the upper surface of the left lobe were several abscesses from the size of a pea to that of a walnut. The bile ducts involved in a necrotic granular mass could not be dissected.

Case XXXVI.—No. 76,928. *Cholelithiasis; Gangrenous Cholecystitis; Suppurative Pericholecystitis; Cholecystectomy; Recovery.*

Mrs. R. B., fifty years old, was admitted on December 4, 1903. There had been repeated attacks of severe pain in the epigastrium and below the right ribs for four years, the pain radiating to the back and interscapular region. There had never been jaundice nor fever.

Her present attack had come on several days before with vomiting, constipation, and fever. There was no jaundice. The patient's general condition was wretched. Her temperature was about 100° F.; pulse, 102, and of very poor quality. There was considerable abdominal distention, and an extremely tender mass was palpable below the free border of the right hypochondrium.

Operation was performed the same day through an incision six inches long between the fibres of the right rectus muscle. A mass of adhesions presented. These were carefully separated after packing off the free peritoneal cavity and a considerable abscess was encountered and emptied. The gall-bladder was then seen to be markedly distended and distinctly gangrenous. It was at once aspirated and twelve ounces of dark hæmorrhagic fluid withdrawn. A few stones in the cystic duct were milked back into the gall-bladder. The viscus was then removed and careful exploration of the common and hepatic ducts performed, after which the cystic was ligated and the wound closed with drainage to the stump.

After its removal the gall-bladder was found to be four inches long and two and one-half inches in diameter. Its mucosa in many places was rough and gangrenous, many spots of gangrene passing through to the peritoneum. It contained a large number of yellow stones, varying in size from a mustard seed to a filbert. None of them were markedly facetted. The pathologist's report on a culture from the fluid showed the presence of streptococci. (Bernstein.)

Five days later the wound was dressed for the first time and was found in excellent condition. There was rather a profuse bile-stained discharge. On the 2d of January, 1904, she was discharged recovered.

Case XXXVII.—*Cholecystitis; Cholelithiasis; Cholecystectomy; Recovery.*

Mrs. K. G., twenty-nine years old, had been sick for three and one-half years with the typical symptoms of biliary colic. She had lost thirty pounds during the past two years. She

entered the hospital on December 29, 1903, in a rather mild attack accompanied by jaundice. She had been referred to me by Dr. T. T. Gaunt.

The liver was palpable at the free border; the gall-bladder could not be felt.

On January 2, 1904, cholecystectomy was performed for stones. There were a few adhesions around the gall-bladder, but the ducts were free.

On its removal the gall-bladder was found thickened, the mucosa hæmorrhagic, and there were four stones from one-half to one inch in diameter.

This patient had several attacks of colic during her convalescence, but without jaundice. They gradually disappeared, and she was discharged well on the 22d of January, twenty days after operation. She remains well at the present writing.*

CASE XXXVIII.—*Cholelithiasis; Cholecystectomy; Choledochotomy; Recovery.*

Mrs. L. G., aged forty-four years, was admitted on the 1st of January, 1904.

For the previous four years she had had innumerable attacks of biliary colic with chilly sensations and jaundice. The attacks usually lasted three to four days and then most of the symptoms subsided. The jaundice had not disappeared after the last attack, which was several weeks before admission, and the patient had lost considerable weight and strength. The itching was very severe; there was no fever.

A large Riedel's lobe could be made out on the right side; the left lobe could be plainly felt below the free border of the ribs. On inspiration, there was a point of tenderness just to the right of the umbilicus.

On January 5 operation was performed. The gall-bladder was found embedded in Riedel's lobe; there were numerous adhesions to surrounding structures. Stones were present in all three ducts and the common duct had to be incised.

The gall-bladder on removal was found greatly thickened; there were several stones, two large ones being respectively one-half and three-quarters of an inch in diameter.

She was discharged after an uneventful convalescence, the

* June, 1904. Patient complains of "indigestion," with pain after eating meat and with considerable belching.

wound healing to a very short sinus twenty-four days after operation.

CASE XXXIX.—*Cholelithiasis; Stones in Cystic and Common Ducts; Cholecystectomy; Choledochotomy; Drainage; Cure.*

Mrs. A. R., patient of Dr. W. M. Brickner, was admitted to the hospital on the 8th of January, 1904. She was thirty-nine years old. Her mother had died of "gall-stones."

Nine years before admission she had had recurrent attacks of colicky pain which had become more and more frequent. The colic had usually lasted from four to six hours, and there had been vomiting, nausea, jaundice, and itching of the skin. There had never been fever nor chills. The jaundice had usually disappeared in about fourteen days. Between attacks the patient said that she felt perfectly well.

On examination the gall-bladder was not palpable, but operation was decided upon because of the history. It was performed on January 9 under gas and ether.

Riedel's lobe extended to the level of the umbilicus; the left lobe of the liver was also enlarged, and the gall-bladder surrounded by adhesions. There were stones in the cystic and common ducts but none in the gall-bladder. The common duct had to be incised for a considerable distance in order to remove a large, soft, friable stone. Because of the character of this stone and because I feared that some of the fragments had slipped into the hepatic duct, I decided to drain the hepatic. This was done by tube, the remainder of the incision in the common duct being closed by suture.

Convalescence was uneventful, and the patient was discharged on January 29, 1904.

CASE XL.—*Acute Gangrenous Cholecystitis; Cholelithiasis; Cholecystectomy; Cure.*

Mrs. A. H. P., thirty-five years old, had always suffered from "stomach trouble." Her first attack had come on about fourteen years before. She had never been jaundiced, but had had attacks every few months. About twelve years before there was a very severe illness with pain in the right hypochondrium.

Her present illness had begun on January 16 with nausea, vomiting, and epigastric pain shooting to the back and arms. Four days later there had developed a distinct tumor in the right hypochondrium with decided general icterus. There was great weakness. I then saw her at the request of her physician, Dr.

Follen Cabot. Operation was proposed and accepted, and she entered the hospital on January 20.

The usual operation was performed, a large, tense gall-bladder being encountered. Ten ounces of dark brown, thin fluid were removed by aspiration. Numerous stones were felt within the viscus; the ducts were free.

The gall-bladder after removal was six inches long, its walls one-half inch thick, covered with ulcerations and with numerous points of gangrene. There were 268 stones from the size of a small shot to that of an almond.

The pathological report on the fluid from the gall-bladder showed staphylococcus aureus.

The first four days after operation the nausea and vomiting were unchecked, but there was no sign of peritonitis. The urine contained acetone in considerable quantity and diacetic acid. During this period the temperature did not reach higher than 101.4° F., but the pulse was extremely rapid, of very poor quality, and the patient's condition seemed precarious. For three days she did not sleep at all, and then at the suggestion of Dr. Manges, who was asked to see her by Dr. Cabot, she received by rectum twenty grains of veronal, after which she slept, and from this time her convalescence was uneventful. She was discharged on February 9, twenty days after operation.

Case XLI.—*Obliterating Cholecystitis; Adhesion to the Walls of a Defect in the Duodenum; Cholecystectomy and Duodenoplasty; Recovery.*

M. P., thirty-five years old, was admitted to the service of Dr. Manges on January 12, 1904. He had begun thirteen months before to suffer cramp-like pain in his abdomen after eating. There had been one attack of jaundice. The pain had been most severe at the pit of the stomach, with radiation into the back and shoulder. It was relieved by vomiting. The patient had lost weight steadily, and there was slight cough with mucopurulent expectoration. Blood had never been noted in the stools nor in the vomiting material.

On examination an area of tenderness was found in the left epigastric region, but there was no rigidity. The stomach was not enlarged to percussion. There was no tenderness in the region of the gall-bladder. On inflation the stomach showed no enlargement below the umbilicus. The blood was examined for bile, but none found. The urine was clear, amber, sp. gr. 1012, daily

amount fifty-five ounces. A faint trace of albumen was present, with 1.5 per cent. urea and numerous hyaline and granular casts. Repeated examinations of the gastric contents had demonstrated the presence of a sufficient amount of free hydrochloric acid. The weight of the patient on admission was 125½ pounds, and a month later, in spite of treatment, it had fallen to 107½ pounds. His weight in health was said to be 160 pounds.

The working diagnosis of ulcer of the duodenum made by Dr. Manges gave with the history of the case sufficient reason for advising an exploration.

On February 12, under gas and ether anæsthesia, the right rectus incision was made for the purpose of exploring the pylorus. A hard, massive adhesion was at once encountered. It was the size of a large man's thumb and was evidently solid. It was firmly adherent to the pyloric region, and on peeling it away a defect in the wall of the first portion of the duodenum was disclosed. This defect was as large as the thumb-nail, and was not made by the peeling away of the adhesion, which was perfectly smooth and had evidently grown fast to the edges of the intestinal opening. The adhesion was now closely examined and proved to be a small gall-bladder with enormously thickened walls. Possibly a calculus had ulcerated into the bowel months before at this point. The defect in the duodenum was closed with silk sutures after digital exploration had shown the pylorus to be normally patent. The gall-bladder was now extirpated in the usual manner, and the abdomen closed with a single drain to the stump. The walls of the gall-bladder were about half an inch in thickness, and the lumen, completely obliterated at some points, admitted a fine probe at others.

Convalescence was uneventful. For seven days after the operation feeding was exclusively by rectum. Then gradually liquid nourishment was given by mouth, and ten days after operation solid food was first given. The patient was discharged March 7.

Case XLII.—No. 77,577. *Chronic Cholecystitis; Stenosis of Cystic Duct; Cholecystectomy; Convalescent.*

Mrs. I. E., fifty-six years old, was admitted February 18, 1904. She had had typhoid fever twenty-six years before. During the six years before admission she had suffered about sixteen times with typical biliary colic and had been jaundiced twice.

Gradually the pain, while not extremely severe, became quite constant.

On physical examination the patient stated that there was a tender point one and one-half inches above and to the right of the navel. The liver was clearly palpable below the free costal border.

February 20, cholecystectomy by the usual method. The gall-bladder contained no calculi, and seemed quite normal in appearance, but the cystic duct was so small that only the finest probe would pass. It was slit open almost to its junction with the common duct, and a large-headed probe passed upward into the hepatic and downward through the common into the intestine. Wound closed after a free escape of bile had been noted. Cigarette drain to stump.

Eight days after operation patient was doing well, only a narrow sinus remaining.*

Concluding Remarks.—1. Cholecystectomy, while not absolutely insuring a cure of cholelithiasis, is the most radical procedure at our command.

2. The primary operation is far safer than the secondary.

3. Judging by my own experience in a sufficient number of cases to warrant an opinion, I believe that primary cholecystectomy is, on the whole, an operation at least as safe as appendicectomy.

4. The operation by the method here described is neat, accurate, and thorough.

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* June, 1904. Patient made an ideal recovery, and was discharged early in March.

PRIMARY SARCOMA OF THE SPLEEN, AND ITS TREATMENT BY SPLENECTOMY.

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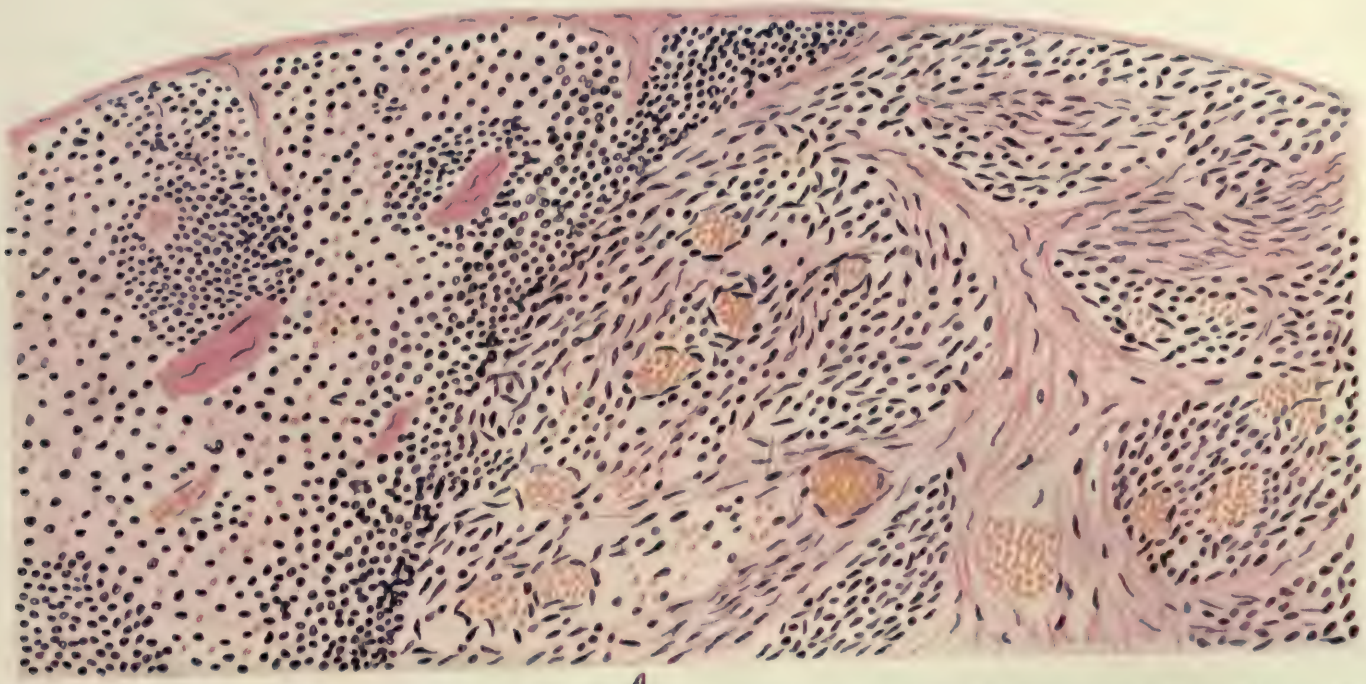
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BELIEVING that the advancement in any field of science must result largely from the accumulated experience of the workers in that field, leads us to present the clinical history and pathological findings of a case of fibrosarcoma of the spleen.

Miss O. S., of Kenross, Iowa, entered the University Hospital, May 13, 1903, at the request of her physician, Clarence C. Heald, giving the following history: Age, fifteen years; her family history, as well as her past history, was negative so far as having any bearing upon her present condition. She had never suffered from malaria, any septic process or any injury, that she had any knowledge of. In fact, she had considered herself well until the early manifestations of her present trouble, which consisted in the appearance, about five months previous, of an enlargement in the left hypochondriac region, particularly noticeable upon standing or lying upon her right side. The growth had been gradually increasing in size. It caused her no particular discomfort, aside from a slight dragging sensation after walking about for some time, and the knowledge that there was something wrong as manifested by the presence of the mass which she could feel in the abdomen.

Her general appearance was that of a person possessed of good health and well nourished. Physical examination of the various organs of the economy gave no evidence of the existence of any abnormality, excepting the spleen, which was in question.



A

A. Section through a portion of spleen and tumor; stained by hæmatoxylin and eosin. Magnification, 300. 1. Border line between tumor substance and splenic tissue. Section through tumor shows large amount of fibrous connective tissue, also poorly formed blood-vessels and round and spindle cells of the sarcomatous process.

No evidence was obtainable indicating that any organ was performing its functions imperfectly.

Urinalysis negative. The same may also be said as regards the blood examination.

Physical Examination.—Inspection of the abdomen, while the patient was lying upon her back, revealed nothing abnormal excepting a slight fulness of the left hypochondriac region. Upon changing her position to the right side, or in standing, the mass was found to descend downward, forward, and inward to the extent that its lower border was about two inches below the umbilicus, seemingly hugging the anterior abdominal wall. The growth, upon the patient assuming the dorsal posture, would recede to the left hypochondriac region. It was not influenced by diaphragmatic movement. Percussion of the colon, with a view to determining its relationship to the growth, when the same was displaced downward, led to some question as to whether the growth was of splenic or renal origin, as the colon was found to pass over the lower part of the growth. Upon palpation, the mass was found to be an elongated one, in the upper half of which the more or less sharply defined edges, indicative of splenic structure, could be fairly well made out; while the lower half of the mass seemed to be more or less lobulated, very dense, and indistinctly merging with the upper portion of the growth. No splenic fissure could be made out. A diagnosis of a solid growth of the spleen was made.

On May 19, 1903, the patient was operated upon through an incision made along the outer border of the left rectus muscle, having its origin an inch below the costal cartilages and terminating about two inches below the level of the umbilicus. This was joined at right angles by another incision about three inches long, running out into the iliocostal space. Before the peritoneum was opened, the purple-colored spleen was already recognized. The spleen was easily brought forward through the wound, and ligation of its pedicle, consisting of the gastro-lienale ligament, in which coursed all the splenic vessels but one, was readily accomplished by double ligation before the spleen was removed. The mesocolon, having been dissected up by the spleen, was opened through its outer border, which was subsequently closed. Owing to the slight oozing from this area, a stab wound in the iliocostal space at the outer border of the kidney was made, into which a

cigarette drain was introduced, which was removed on the second day.

Recovery uneventful. She left the hospital on the twenty-fourth day.

Present Condition.—On December 22, 1903, upon request, she presented herself at the hospital and the case was carefully gone over. Her general appearance was that of a person in good health. She expressed herself as having been in perfect health since her return home. Menstruation has been normal the past five months.

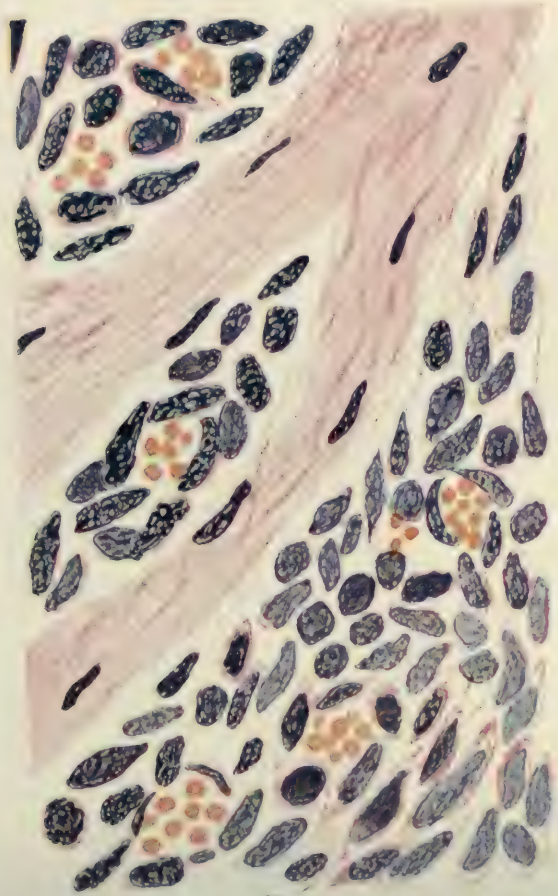
Examination of the various organs was negative. Abdomen palpable without pain or undue rigidity. The region occupied by the spleen, as well as the contiguous structures, were free from induration, the liver seemingly normal.

Blood Examination.—A blood examination was made two days prior to the operation and at intervals of two to three days following the operation. The patient was quite anæmic and had a moderate leucocytosis before operation. After the operation, the red corpuscle count fell for several days, then gradually the number increased. A marked leucocytosis was present immediately after the operation, which continued as long as the examinations were made. The amount of hæmoglobin varied in proportion to the number of red corpuscles.

Some poikilocytes, microcytes, macrocytes, and nucleated red corpuscles appeared, especially after the operation.

BLOOD EXAMINATIONS.

Time of Examination.	Number of Red Corpuscles per Centimetre.	Number of White Corpuscles.	Per Cent. of Hæmoglobin
Two days before operation.....	5,260,000	6,120	72
One day after operation.....	3,346,000	22,200	64
Three days after operation.....	3,116,000	24,500	58
Five days after operation.....	3,320,000	16,200	62
Nine days after operation	3,810,000	23,400	62
Thirteen days after operation.....	4,360,000	27,000	61
Seventeen days after operation....	4,330,000	24,560	60
Twenty-one days after operation...	4,320,000	23,120	62
Twenty-four days after operation..	4,336,000	23,220	63
December 22, 1903, the seventh month after	4,420,000	10,810	84



B



C.

B. Section through a portion of the tumor. × 1200. Stained by hæmatoxylin and eosin.
C. Section through a portion of spleen and tumor. × 450. Stained by Van Gieson's method; connective tissue is stained red. 1. Border line between splenic tissue (above) and tumor substance (below).

The entire specimen, consisting of spleen and tumor mass, is 17 2-4 centimetres long, and varies in width and thickness at different places, as will be described later. It weighs 256 grams, about one-fourth of which represents the weight of the spleen, the remainder the weight of the tumor. The tumor is attached to and apparently occupies the lower portion of the spleen. It is quite well encapsulated. The capsule of the tumor and the line of demarcation between the spleen and tumor are not easily distinguishable, so that the tumor mass appears to be continuous with the splenic substance.

The tumor is rather spherical in general outline and has a circumference of 23½ centimetres. The surface of the tumor presents a rather nodular appearance, which is most marked along the lower and external surfaces. The mass is quite hard and firm, considerably more so than the spleen, and is of a dark purple red color, a color practically the same as that of the external surface of the spleen.

The specimen was cut in such a way that the incision extended along the middle of the external or phrenic surface of the spleen, and then continued through the tumor mass. The cut surface of the tumor area is of a bright red color, quite uniform over the entire surface, but here and there are found dense bands of tissue of a white color with a slight tinge of blue. The dense bands are at certain places four millimetres wide, at other places they appear as delicate threads. Some of them appear to be sharply defined from the surrounding red-colored tissue; others seem to diffuse gradually into the surrounding substance. The dense fibrous tissue is rather irregularly distributed, and it is the contraction of this tissue that accounts for the place on the external surface which produced a depression about one centimetre deep. The upper portion of the tumor fits into a concavity made by the base of the spleen. The upper border of the tumor is readily recognized and easily distinguished from the splenic substance by the bright red color of the former as compared with the yellowish brown color of the latter. At one place, however, the border line is not so readily noted. It appears as if there has been a slight interchange of splenic and tumor substance. Although apparently well circumscribed, a distinct connective-tissue capsule is recognizable only at the periphery, where a small strip which is connected with the capsule covering the spleen and tumor externally extends in-

ward between the spleen and tumor for about one-half centimetre on all sides. The tumor is nine and three-fourths centimetres long, eight and one-fourth centimetres wide, and seven and three-fourths centimetres thick.

The spleen itself appears to be but little affected. It has a pyramidal form, the base in contact with the tumor. The base is, however, not represented by a flat surface, but has considerable of a concavity which lodges the upper portion of the tumor mass. At the base the spleen is seven centimetres wide and four centimetres thick. The apex comes to a quite sharp point. The external or phrenic surface presents a normal convexity and is seven centimetres long. The intermediate ridge separating the gastric from the renal surfaces is quite well marked and is seven centimetres in length. The gastric surface is flat and only three and one-half centimetres wide at the base. The anterior margin is eleven centimetres long and contains no notches. The posterior border is more blunt and is only eight centimetres long. The hilum is located on the gastric surface, beginning six and one-half centimetres below the apex of the spleen, at first adjacent to the intermediate ridge, then extending outward and downward towards the anterior border, terminating at a point between the spleen and the tumor, two centimetres from the anterior border of the spleen. The ligaments constituting the pedicle of the spleen have an attachment extending from above the hilum downward, covering the internal surface of the tumor for two and one-fourth centimetres. The vessels passing into and coming from the organ enter the spleen directly through the hilum, with the exception of two, which enter the substance of the tumor. The spleen has a normal, dark purplish-red color and is normal in consistency.

The size of the spleen as compared with the size of the patient seems to indicate that there has been but little, if any, destruction of splenic substance.

On microscopic examination it is found that different portions of the tumor present different conditions. In most places there is found a dense field of cells, some of which are round, but the majority are spindle shaped. Most of the cells have a large nucleus rich in chromatin and surrounded by a small amount of cytoplasm, in others the cytoplasm is large in amount. Between some of the cells there is found the distinct elements of fibrous connective tissue. The dense white areas noted above

are made up of an almost homogeneous fibrillar connective tissue containing only a few muclei.

The blood-vessels of the tumor are very poorly formed, most of them lined simply by endothelial cells or by the tumor cells themselves. In certain places, a number of red corpuscles are seen lying free between the tumor cells. A section through the specimen at the place where the tumor borders on the splenic substance reveals the absence of a distinct capsule. The border-line between the two structures can, however, be fairly well determined. The splenic tissue lying adjacent to the tumor substance consists of normal splenic elements very closely crowded together, even more so than are the cells of the Malpighian corpuscles. In this dense splenic tissue, which is from one-fourth to one-half centimetre wide, no blood-vessels were found, and only here and there an occasional red corpuscle, so that this tissue can really be considered as a limiting membrane, preventing any rapid spread of the tumor into the substance of the spleen proper. The splenic tissue elsewhere appears to be normal.

That the spleen is not an organ essential to the maintenance of a fair degree of health has had abundant proof through the numerous splenectomies of the past half -century. Thus, of the 274 cases of extirpation of the spleen which it was possible for Van Verts to report in 1897, 170 recovered, while the 360 cases collected by Hagan in 1900 give a mortality of only 38.3 per cent.; and we have no doubt that were statistics obtainable to the present time, an equally good, if not a much better, showing could be made. The result is that the spleen is being rapidly forced into that large list of organs which are being subjected to operative procedure on the part of surgeons. Of these procedures, splenectomy has won for itself a fixed place, and must henceforth be looked upon as a rational means of treatment in certain pathologic conditions of the spleen. Yet, when we come to a consideration of what these conditions are which shall form such indication, we realize that much remains to be done in this direction, and in no particular class of cases is this more evident than in the treatment of neoplasms of this organ. The paucity of accumu-

lated experience of the profession may be considered as responsible for this to a large extent.

It has long been recognized as a fact that the spleen is possessed of a relative immunity to secondary involvement by new growths, while the existence of malignant neoplasms having their origin primarily in this organ has been so infrequently observed that some doubt has been expressed as to their existence. Litten, in Nothnagel's Series, Vol. viii, 1898, states that "Primary sarcoma of the spleen is very rare." Mosler, in his work upon "Diseases of the Spleen," in 1875, knew of no case, and B. Grohe, in "Virchow's *Archives,*" in 1897, writes as follows: "Tumors of the spleen recognizable during health occur very seldom. Of heteroplastic tumors of the spleen, only a few cases are known. Primary sarcoma appears more than doubtful, while primary sarcoma of the spleen is extremely rare."

Weichselbaum was the first to report any cases of primary sarcoma, if we exclude the case reported by Friedreich in 1865, under the title of "Multiple Nodular Hyperplasia of the Liver and Spleen," which Bunting, however, believes to have been a primary sarcoma of the spleen. Weichselbaum (Virchow's *Archives,* 1881) states that until that time there existed no records of any cases in medical literature. He then proceeds to report two cases. Since that time there may be found scattered through medical literature reports of a fair number of cases, which have been recorded as primary malignant neoplasms of the spleen. We herewith append a list of those so far recorded. The total number which we have been able to gather from various sources is thirty-two, including the one here reported. It will be understood that much doubt must exist as to whether all of the cases included in this number rightfully belong there, as some of the cases were recorded as such without having their true nature determined by careful microscopic examination of the specimen. And in some of the cases the clinical history and gross findings are at variance with our present conception of primary neoplasms, as will be pointed out later in dealing with the operative cases.



Sarcoma of spleen, gross specimen.

Of the above thirty-two cases, twelve were subjected to operative interference, eleven to splenectomy, and one to enucleation of the growth. The latter case was that of Heinricius, in which instance there no doubt existed a pedunculated primary fibrosarcoma of the spleen, developing from its capsule, which at the time of the operation was looked upon as a benign growth, and was consequently subjected to enucleation, with the result that probably a portion of the growth remained through which recurrence took place. It was only after a microscopic examination of the growth was made that it was found to be a fibrosarcoma with myxomatous degeneration. Heinricius expresses himself as follows regarding this case: "Had I known at the time of the operation that the growth was malignant, it would have been more proper to have extirpated the spleen, although the organ itself appeared, and evidently at the time was, normal." Case died seven days after the operation.

Of the eleven splenectomies, three died following the operation, namely, the cases of Flothmann, Collins, and Krylow.

The case of Flothmann was that of a man aged forty-four years, cachectic, possessed of a four-pound splenic growth, which was adherent upon all sides to adjacent structure. At the termination of the operation there was observed in the omentum the existence of a tumor about the size of a man's fist. Its removal was also undertaken. Death followed fifty hours later from acute anæmia. The spleen was studded throughout with innumerable small growths, some as large as a hazel-nut. As this case presents a picture somewhat typical of metastasis to the spleen, it is believed there exists some reason for excluding it from among primary sarcomas of the spleen.

The case of Collins was that of a male, aged thirty-six years, who had suffered severely from malaria ten years previously while a soldier in the English army in India, since which he had, however, been apparently well until two months prior to the operation, at which time he noticed a growth in the left side, which was increasing in size and at times was painful. He had lost fifteen pounds in weight in these months. No other symptoms existed. Blood examination revealed white corpuscles, 5000; hæmoglobin, 60 per cent. At the operation, January 11, 1900, the spleen was found to be extensively adherent to surrounding structures. A portion of the pancreas was removed with the growth. A portion of the spleen not affected by the growth was allowed to remain attached to the

cardiac end of the stomach. Death followed on the sixth day, due to acute general peritonitis, pleuritis, and streptococcus septicæmia. Growth consisted of a small round-cell sarcoma about the size of two fists, and a sarcomatous mass size of palm of hand, with some pancreatic tissue and a small supernumerary spleen about the size of a walnut.

In the case of Krylow, which we quote from Simon, he having quoted the same from Hildebrand's Jahresberichte. "Splenectomy was undertaken in a patient fifty-one years old, much emaciated. Much hæmorrhage resulted from the operation, the patient dying four hours later. The tumor was reported to be a sarcoma, weighing eight and one-half pounds, which had existed for three years." The remaining eight cases which recovered from the immediate effects of the operation are as follows:

Case of Billroth (reported by Von Hacker). Patient, female, aged forty-three years. Tumor and spleen of large size, weighing 1450 grams. Tumor was smooth in front, but possessed of a protuberance posteriorly. Lower border divided by three fissures. The tumor was quite painful on pressure, which pain was reflected to left shoulder. The same was diagnosed by Billroth prior to operation as a sarcoma. The spleen was removed; it being the first case of splenectomy for sarcoma. The tail of the pancreas was found adherent to the tumor growth, seven centimetres of which were removed. The tumor was seventy-five centimetres in circumference, twenty-five centimetres in length, and eighteen centimetres in width. Microscopic examination showed it to be a lymphosarcoma. The growth had probably existed over ten years, as for that length of time at least there had been observed a marked fulness in the upper left quadrant of the abdomen, and for seven years there had existed two growths of a size sufficient to be palpable. The last two years were marked by rapidly increasing growth. Three weeks subsequent to the operation there existed a slight leucocytosis. The patient died six months later from recurrence.

Jordan's case was that of a patient, fifteen years of age, who in June, 1895, was subjected to an operation by him for the removal of an enlarged lymph node about the size of an egg, from the submaxillary region of the left side, which microscopic examination seemed to indicate as being a lymphosarcoma. Some time later the patient began suffering very severely from pain in the splenic region, and in August, 1896, the spleen was removed. It was found to be the seat of a sarcoma with metastases in the structure of the hilum. The patient is supposed to have died of recurrence. May it not be that this case should be expunged from the list of primary sarcomas of the spleen, owing to the fact that it may have been secondary to the sarcomatous lymph node previously removed?

In the case operated upon by Professor Kocher, no definite history is possessed as regards the case, excepting that the spleen was the seat of a lymphosarcoma with many regional metastases involving the liver and mesenteric lymph nodes. It was considered by Vulpius, Braun, Litton, and



Sarcoma of spleen, gross specimen. Section through tumor.

others as a primary sarcoma of the spleen. Simon, however, has raised the question as to whether the patient did not suffer from a generalized lymphosarcoma, in which process the spleen became secondarily involved.

As regards the case of Herczel, we again quote from Simon, who quotes the same from Hildebrand's Jahresberichte.

The case was that of a fourteen-year-old boy, in which a growth had been noticed for one week. The extirpated spleen measured twenty-five by nineteen centimetres, and weighed 2456 grains. Within the otherwise perfectly normal spleen, there existed what was considered a primary sarcoma of the spleen about the size of an apple. Following the operation there existed a marked leucocytosis, the patient recovering, but as regards subsequent history nothing is known.

The case of Fritch was that of a woman aged thirty-one years, multipara, who had since March, 1887, suffered with severe pain in the region of the spleen, at which time a small tumor had also been observed in the hypochondriac region, which grew rapidly until June 24, 1887, at which time she was operated upon. Blood examination in this case was normal. The recovery was uneventful, and on the 24th of November the following year she gave birth to a still-born child. The woman died six and one-half years later of what was presumed to have been a cardiac lesion. No post-mortem was obtainable. The spleen was seemingly normal, excepting at one point upon its convex surface, where existed the growth in the splenic structure, which upon section seemed to be well circumscribed, although not sharply so, from splenic structure.

Wagner's case was that of a woman aged twenty-seven years, multipara, last confinement, which was followed by normal puerperium of two weeks' duration, preceded the operation by seven weeks. The growth, which was readily movable, and about the size of a child's head, was first noticed after her getting up from her confinement. The palpable surface of the tumor seemed more or less smooth, of about the consistency of the liver. Microscopic examination of the blood showed a normal relationship between the reds and whites and the normal quantity. The patient was operated upon November 30, 1893. Recovery uneventful. In April, 1894, her condition was excellent. Van Verts reports her in 1897, which is three years later, as in good condition. The spleen and tumor weighed 1285 grams, and measured $19 \times 9\frac{1}{2} \times 10$ centimetres.

Garre's case, reported by Simon, was that of a woman thirty-eight years of age, iv para, who since her first confinement, eleven years previously, had suffered some distress in the gastric region. When about five months advanced in last pregnancy, she began to suffer much from pains in left hypochondriac region, which, however, subsided in the course of a short time. Normal confinement. In about five months there was a recurrence of the pain in the left hypochondriac region, though not severe.

The general condition of the patient at this time was that of one being in fair health. Urine normal. Blood; reds, 4,310,000; whites, 5000 per centimetre. Growth felt in left hypochondriac region. Diagnosed as sarcoma of spleen. Splenectomy. Recovery uneventful. Blood count, post-operative: second day, reds, 2,350,000; whites, 8600. Seventh day, reds, 3,600,000; whites, 7800. Thirtieth day, reds, 4,100,000; whites, 7000. A hæmoglobin, 50 and 60 per cent. Spleen measured $22 \times 13.5 \times 11$ centimetres, and weighed 1750 grams. Microscopically, growth shown to be a round-celled sarcoma. Reported free from recurrence at the end of four months.

Of the eight cases that survived the immediate effects of the extirpation of the spleen, three cases have died of recurrence (Billroth, Jordan, and Kocher), and regarding one (that of Herczel) there exists no data which can be utilized in determining freedom from recurrence. Of the four remaining, two at least may be said to have been free from recurrence, namely, the case of Fritch, living six and one-half years, and Wagner's case being well at the end of four years. In the remaining two cases, namely, Garre's and the one here reported, it cannot be said that a sufficient time has elapsed since the operations to eliminate the possibility of recurrence; yet, the fact that the first was, after careful examination at the end of four months and the latter at the end of ten months, found to be possessed of good health, without any discernible evidence of recurrence, entitles one to the belief that freedom from recurrence may be the result. If this be true, primary sarcoma of the spleen may be looked upon as highly amenable to a cure through splenectomy, for, from the foregoing list of cases operated upon, we should, in trying to determine the amenability of the spleen to operative interference, in the case of malignant growths, exclude all cases where the same have given rise to metastasis or is under the suspicion of having been secondarily involved. Such would be a contra-indication in any organ or tissue of the body. The three cases in which recurrence took place fall in this class.

It is quite possible that future experience may show that it will be necessary to further take into consideration, when determining the amenability of the sarcomatous spleen to

extirpation, the tissues from which the same arises. Thus the spleen offers three types of connective tissue from which it may originate. First, the capsule and trabecula; second, lymphoid structure, and, third, the endothelial cells, which give rise respectively to the fibrosarcomata, lymphosarcomata, and endothelialsarcoma.

Diagnosis.—A diagnosis at an early stage, before the occurrence of metastases, is of course an essential in the treatment of malignant growths here as elsewhere in the economy.

The early recognition of malignant growths of the spleen presents some real difficulties, on account of the meagre symptoms, which result from its presence. We could only expect the presence of three symptoms, namely, 1. Enlargement of the spleen. 2. Pain. 3. Blood changes.

1. The first symptom, namely, enlargement, must be difficult of recognition in the early stage, owing to the protected position of the spleen making palpation impossible, while percussion is not to be relied upon. Owing to the only moderate support which the spleen has through the reflections of the peritoneum, it seems that the increased weight soon lengthens these attachments, with the result that the spleen at an early period acquires a range of mobility making it possible for it to descend below the costal margin, where it may become palpable, thus giving us the most trustworthy evidence possible of attainment in the light of our present knowledge of the subject. It having been determined that the growth pertains to the spleen, the nature of the enlargement will present itself for solution. The physical characteristics of the growth will largely aid in this. Thus, if the spleen is uniformly enlarged, with its normal shape well maintained, it would be a justification for excluding all primary neoplasms, at least in the early stage of their formation. While if, on the other hand, the spleen is not uniformly enlarged, but the seat of nodosities, or localized enlargement, it would bring up for review those various conditions capable of bringing this about. If it is possible to determine by palpation or aspiration (this latter means of diagnosis is probably not so safe as that of explora-

tion in capable hands) that the enlargement is cystic, then, of course, there is excluded echinococcus and other cysts as well as abscess of the spleen. The growth being a solid one, the question of its being a sarcoma, fibroma, angioma, or lymphangioma appears for solution; and this must certainly be at times quite impossible until the growth is exposed to inspection by an exploratory incision; although, in the instance of Billroth and Garre's, it is said that a diagnosis was made prior to operation. Theoretically, we would expect rapid growth, yet a review of the cases does not show this to be always so. This phenomenon has had much stress laid upon it as a symptom by Ledderhose, Litten, Braun, Krause, and others; but it must often fail in being of real value, owing to the fact that it must be very difficult to determine this in many instances; and if malignancy is suspected, it would seem unwarrantable to defer treatment until the rapidity of growth could be definitely determined.

2. Pain. Considerable pain would be expected to exist, owing to the distention of the splenic capsule; yet this does not seem to be a symptom of much value, as it is often absent, and if present, a misinterpretation of its significance must often occur, owing to the proximity of this organ to the stomach and left kidney.

3. Blood examination seems to be of no real value from a diagnostic stand-point as revealed by the results of those undertaken in the cases so far reported.

An analysis of the symptomatology of primary sarcoma leads to the belief that the diagnosis must, for the present at least, be largely based upon the recognition of the existence of a solid growth in the spleen, and that a definite diagnosis cannot be made until the spleen is exposed through an exploratory incision, which, it seems to us, would always be indicated where doubts exist.

Treatment. As to treatment, no question can exist as to the advisability, in the absence of secondary involvement of other organs, of removing the spleen, which in the hands of the experienced surgeon must be associated with but a small

mortality; and it is believed that the results of the work so far undertaken are such as to justify the hope that a very large per cent. of primary sarcomas of the spleen will be proven susceptible of a radical cure.

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CASES REPORTED AS PRIMARY SARCOMA OF SPLEEN.

No.	Age.	Sex.	Reported by	Spleen.	Other Organs.	Symptom.	Classification of Growth.
1	56	M.	Friedreich, 1865.	Post-morten specimen. Spleen seat of many small tumors, varying in size from those being just visible to the size of a pea.	Liver was involved by similar growths.		Primary endothelial sarcoma of spleen. So classified by Bunting.
2	21	M.	Weichselbaum, 1881.	Spleen much enlarged, with nodular growths throughout its structure.			Primary endothelial sarcoma. Birch-Hirschfeld classed it among the nodular hyperplasias.
3	21	M.	Weichselbaum.	Tumor arose in substance of spleen, from which it was easily separable, and projected above the convex surface.	No metastasis.		Primary fibrosarcoma.
4	55	F.	J. Weber, 1901.	24 by 10 by 17. About one-quarter of which appeared normal, the remainder being of a uniform grayish color.	Metastasis in mesentery, omentum, and retroperitoneal lymph-nodes.		Lymphosarcoma.
5	39	M.	Schönstädt, 1891.		No metastasis.		A mixed tumor, partly of the nature of a fibroma and partly endothelioma.
6	20	M.	Grohe, 1897.	28 by 13 by 18 centimetres. Permeated throughout by nodular growths, but small amount of splenic pulp.	It was adhered to diaphragm, stomach, and left lobe of liver.	History of a previous fall followed by pain in left side. Hæmoglobin 70 per cent. Reds, 4,640,000; whites, 15,400	Lymphosarcoma. Birch-Hirschfeld believes it to have been a large hyperplasia.
7	49	M.	Bunting, 1903.	Spleen enlarged, weighing 250 grammes. Bulk of organ appears to be made up of grayish opaque tissue.	Metastasis to liver, pancreas, gastrohepatic lymph-nodes, and subcutaneous tissue.	Had been incapacitated for labor before death by reason of pain and discomfort for a period of only sixteen days.	Primary endothelial sarcoma.
8	54	F.	Casott.	5000 grammes.	Metastastis throughout the abdomen.		Primary round-celled sarcoma.
9	28	F.	Woodruff.	Pendiculated tumor arising from the spleen.			Primary sarcoma.
10	13	M.	Baccelli, 1876.	Weight of spleen, 2400 grains.	Metastasis liver, gall-bladder, and descending colon.	Patient had previously suffered from malaria.	Primary lymphosarcoma.
11			Trelat.				Primary lymphosarcoma.
12			Picon.	} Have reported cases. The pathological picture varies from sarcoma of spleen, chiefly in the greater development of connective tissue in the spleen, which one would expect from the greater chronicity.			
13			Ramond.				
14			Bovaird.				

CASES REPORTED AS CARCINOMA OF SPLEEN.

15			Moslier.	} With metastasis in liver and peritoneal cavity. As microscopic examination was made only in the last two, they should probably be classified either among the sarcomas or splenic anæmias.
16			Parker.	
17			Perry.	
18			Bridges.	
19			Clark.*	
20	5	M.	Notte.	Case considered by Litton as a sarcoma of the kidney.

* A case reported by Clark as a congenital small round-celled sarcoma of abdomen, including in its growth the spleen and left testicle, and filling whole left side of abdomen, should probably be excluded, as origin of tumor was not definitely ascertained.

CASES SUBJECTED TO OPERATION.

No.	Age.	Sex.	Reported by	Splenectomy	Result.	Spleen.	Other Organs.	Symptom.	Classification of Growth.
21			Heinricius.	Enucleated growth by Heinricius.	Death seventh day.	Pedunculated fibrosarcoma arising from spleen. Weight, 500 grams.	No metastasis.	None except as manifested through presence of growth.	Primary fibrosarcoma.
22	54	M.	Flothmann.	Splenectomy.	Death fifty hours after the operation from symptoms of acute anæmia.	Splenic tumor weighed four pounds and permeated by innumerable small growths, largest size of hazel-nut.	Extensive adhesions. Growth size of fist in omentum.	Not given.	Primary lymphosarcoma.
23	51		Krylow.	Splenectomy by Krylow.	Death followed four hours after operation from acute anæmia.	Spleen and tumor weighed eight and a half pounds.	Extensive adhesions, involving pancreas and stomach.	None except presence of growth.	Primary small round-celled sarcoma.
24	36	M.	Warren, 1901.	Splenectomy by J. C. Warren. A portion of spleen left attached to stomach. Part of pancreas removed.	Death sixth day after operation of general peritonitis, pleuritis, and streptococcus septicæmia.	Size of growth that of two fists.	Extensive adhesions to pancreas and stomach.	No symptoms except presence of growth in left hypochondriac region, and loss of weight.	Primary small round-celled sarcoma.
25	43	F.	Von Hacker.	Splenectomy by Billroth.	Recovery. Died six months later from recurrence.	Spleen and growth weighed 1450 grams and measured 25 by 18 centimetres.	No adhesions on convex surface. Omentum and loops of intestine adherent at concave surface. Four centimetres of spleen removed with growth.	For seven years had noticed growth size of two fists in left hypochondriac region. Rapid growth last two years. Marked pain.	Primary lymphosarcoma.
26			Kocher.	Splenectomy by Kocher.	Recovery. Subsequent death from recurrence.	Spleen uniformly enlarged.	Metastasis liver and mesenteric lymphnodes.		Primary lymphosarcoma.

27	15		Jordan.	Splenectomy by Jordan.	Recovery and subsequent death by recurrence.	Sarcomatous growth in spleen metastasis into hilum.	Fourteen months previous to splenectomy an enlargement submaxillary lymph-node removed, which was a lymphosarcoma.	Pain in splenic region and enlargement in same region	Primary sarcoma.
28	14	M.	Herczel.	Splenectomy by Herczel.	Recovery. Subsequent history not.	Spleen and growth weighed 2456 grams and measured 26 by 19 centimetres. Sarcomatous growth structure size of apple.	No metastasis.	Presence of growth recognized only one week before the operation. No other symptoms recorded.	Primary round-celled sarcoma.
29	29	F.	Wagner, 1894.	Splenectomy.	Recovery. No recurrence.	Weight, 1285 grams. Size, 19 by 9½ by 10 centimetres.	No adhesion and no metastasis.	Seven weeks after last confinement, which was normal, noticed growth in left hypochondriac region. No discomfort from it. Blood count normal.	Primary endothelial sarcoma, Bunting. Round-celled sarcoma, Marchand.
30	31	F.	Fritch, reported by Asch.	Splenectomy by Fritch.	Recovery uneventful. Normal confinement eight months after operation. Died six and a half years after operation of cardiac lesion.	Weight of spleen and growth, 2 grams. Size, 22 by 14 by 10 centimetres.	No adhesion and no metastasis.	Severe pain for three or four months prior to operation. Pregnant five weeks. Tumor in left hypochondriac.	Primary lymphosarcoma.
31	37	F.	Simon.	Splenectomy by Garré.	Recovery. Condition of patient good at end of one year.	Spleen and growth weighed 1750 grams and measured 22 by 13.5 by 11 centimetres.	No adhesion and no metastasis.	None except some pain and the presence of the growth. Duration of growth not given.	Primary round-celled sarcoma.
32	15	F.	Jepson and Albert.	Splenectomy by Jepson.	Recovery. Condition of patient good at end of ten months.	Spleen and tumor weighed 256 grams. Tumor weighed 190 grams and measured 9½ by 8¼ by 7¾ centimetres.	No adhesion and no metastasis.	None except those of presence of growth, which was recognized five months prior to operation.	Primary fibrosarcoma.

HERNIA OF THE UTERUS THROUGH THE INGUINAL CANAL.[1]

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THE following is the report of a case of inguinal hernia of the uterus, with operation and recovery.

H. B., colored, aged twenty-seven years, occupation, housewife; married nine years; has had three children (all living), now aged eight, seven, and three years. No miscarriages; menstruation normal. Patient has had a small, right inguinal hernia as long as she can remember. This was about the size of a walnut, a small, hard, painless protrusion, which always descended when she was upon her feet and disappeared on lying down. It never was observed to be irreducible, and gave her no trouble. A truss had been recommended, but she had never worn one.

On January 20, 1904, one week before admission to the hospital, and while occupied in washing clothes, but not, according to her account, making any especially severe exertion, a large protrusion, much larger than ever before observed, made its appearance in the right groin. Its development was accompanied by severe pain in that region, forcing her to lie down. She remained in bed, the pain becoming more severe. She had neither vomiting nor constipation, and was not aware of the presence of fever, and had no chill.

She was seen by Dr. J. H. Cloud, who sent her to the Bryn Mawr Hospital on January 27, 1904. She was in excellent condition at that time. Examination showed a swelling, half the size of the fist, in the right inguinolabial region, coming from the external abdominal ring; hard, irreducible, somewhat tender, evidently an irreducible, complete, inguinal hernia. The absence of symptoms of obstruction, with her history, made probable the

[1] Read before the Philadelphia Academy of Surgery, March 7, 1904.

diagnosis of omental hernia,—epiplocele. Operation was advised, and consented to, and the patient was admitted about noon of the same day. The temperature on admission was 98 2-5° F., her pulse and respiration normal. In the evening the temperature was 100° F. Dr. Walter Christie, the physician on duty, also examined her, and concurred in the advisability of operation.

Operation, January 28, Dr. Christie assisting. Under anæsthesia the hernia was again examined and found to be irreducible. No prolonged taxis was attempted. An oblique incision over the neck of the tumor showed it to be pear-shaped, the wider end presenting, the sac adherent at the fundus or peripheral portion, and free at the constricted base. The sac was opened at the latter point and peeled away. The examination of the contents was at first confusing, although we were still under the impression that the bulk of the mass was omentum. While endeavoring to unfold it, it suddenly split longitudinally, and about three-quarters of an ounce of yellow, odorless pus escaped from its interior. This was quickly sponged away, and an ovary was then seen to be protruding from the inguinal canal to the right side of the neck of the mass, and what had been supposed to be a large intestine flattened out by pressure, was found to be the broad ligament and Fallopian tube of the right side. It was then discovered that the herniated mass was the uterus turned over forward, the supravaginal portion running backward, downward, and inward towards the cervix. A vaginal examination determined the continuity of the cervix with the mass, and the examining finger was easily felt through the upper vaginal wall immediately in front of it. The necrotic and infected condition of the body of the uterus forbade its reduction, and it was decided to remove it with the right ovary, which was now prolapsed through the external ring. This was done, after applying a series of silk ligatures to the broad ligaments, tubes, and supravaginal portion of the uterus, which formed the pedicle, and the adherent sac was also cut away. The presence of pus in the cavity of the uterus rendered infection of the wound possible, and it was not deemed advisable to drop back the stump or to open up the inguinal canal and perform the Bassini operation as we had intended. To secure drainage from the possibly infected stump, to exclude it from the peritoneum, and to close, as far as possible, the canal, we decided to fasten the pedicle in the external abdominal ring, and closely sutured the pillars of

the latter with chromicized catgut above, around, and below it. A small gauze wick was then laid over the stump, and the wound closed in its deeper portion by a continuous chromicized gut suture, and the skin with silkworm gut, the gauze being brought out at the lower angle.

After operation the patient's condition was excellent. The temperature in the evening was 98 3-5° F., the pulse 92. The following day, the 29th, a bloody vaginal discharge appeared. The highest temperature recorded after operation was on the evening of the 29th, 100 1-5° F., the pulse 80. The wound was dressed on the 30th, and when the gauze wick was removed, a small quantity of bloody mucus followed it, and again on February 1, when a small rubber tube was inserted instead of the gauze, to drain away the mucus discharging from the stump. This was removed two days later, and the wound quickly healed without infection, being solid, and the stitches removed on the tenth day. The vaginal discharge lessened and disappeared in a few days after operation. The patient complained of some pain across the lower portion of the abdomen after the wound was healed, but this soon disappeared. Menstruation appeared on February 25, was profuse, as usual, and lasted four or five days, with the usual slight pain in the hypogastric region. The patient was allowed to get up after four weeks, and suffered no further inconvenience. An examination made February 29 showed the wound solidly healed, no hernia or unusual impulse on coughing on that side, the stump of the uterus easily palpable by bimanual examination and slightly movable, upward and downward, the cervix being tilted somewhat downward.

Sections through the body of the uterus were made by Dr. W. Bradford Eaton, Pathologist to the Hospital, who very kindly furnished me the following report:

"The section studied was taken from the uterine wall, bordering the large abscess ruptured at time of operation (uterine cavity). The wall was of average thickness, and showed direct evidence of pyogenic infection. The sinuses in places were densely infiltrated with polymorphonuclear leucocytes, and scattered through the specimen were many foci of densely crowded pus-cells. The part of the specimen bordering upon the abscess showed what at first seemed to be a remnant of placental tissue, but which further study showed to be particles of blood-clot that were held by the necrotic

remnants of the endometrium. Here and there could be seen remains of mucous glands and occasional strips of degenerated uterine mucosa. The condition corresponded to that found in intense hæmorrhagic and pyogenic infection, such as was apparently present in this case."

The persistence of menstruation is explained by the fact that the amputation was done some little distance above the internal os, and the left ovary was not removed, although its tube was, of course, tied off with the pedicle. It was not drawn out or observed during the operation.

While the presence of an ovary in the sac of an inguinal hernia is not very uncommon, most operators of large experience having encountered it one or more times, the presence of the uterus is one of the rarest phenomena of hernia. But while of great rarity, its occurrence has not escaped the attention of some of those who have made a special study of hernia and of affections of the female genitalia, and cases of umbilical, ventral, inguinal, crural, and of alleged obturator and ischiatic hernia have been recorded. The ventral forms occur most frequently, being usually situated below the navel, from separation of the recti muscles during pregnancy, and will not be considered here. The cases of other varieties than umbilical and ventral, except inguinal and crural, which are on record, viz., ischiatic and obturator, are probably apocryphal. Careful studies of the cases of inguinal and crural hernia of the uterus which are on record have been made from time to time by Cormack,[1] Klob,[2] Eisenhart,[3] Adams,[4] Winckel,[5] and Küstner,[6] who have compiled lists of the cases, more or less complete. A careful study of these papers shows that considerable confusion exists as to some of the cases in the early literature, both as to their authenticity and their exact nature. Thus the oldest case, that of Nicholas Pol (1531), has been claimed to be identical with one of those mentioned by Senertus and Hildanus (1610), while another described by these authors, and attributed to Doringius, is variously classified as inguinal and crural, or omitted. Another case, given by Skrivan and Lumpe as a true hernia of the pregnant uterus, has been ex-

cluded on the ground that it was an extra-uterine pregnancy. By a study and comparison of these papers and of many of the original references, and a review of the literature since their appearance, the following classification of the cases seems justified. It is practically the same as Küstner's, with the addition of six cases which he excluded, or overlooked, or which have been published since his article appeared. The pregnant uterus has occupied the sac of an inguinal hernia in whole or in part nine times (observations by Pol, Senertus, Saxtorph, Ladesma, Fischer, Rektorzik, Scanzoni, Winckel and Eisenhart, Rosanoff). The non-pregnant uterus has been previously observed in inguinal hernia at least twelve times (Maret, Lallement, Chopart, Olshausen, Leopold, Schwarz, Brohl, Krug, Defontaine, Legueu, Rouffart, and Diederich). Two undisputed cases of crural hernia of the non-pregnant womb have been recorded by Lallement, and Boivin and Dugès, and the case of Doringius previously mentioned, a hernia of the pregnant uterus, has been variously classified as inguinal, crural, or possibly between the muscular fibres of the abdominal wall, or altogether excluded.

The case of F. Krug[7] has not been included heretofore, Winckel and Küstner, writing since its publication, not mentioning it, but is an undoubted example of hernia of the non-pregnant uterus, left ovary and tube, of the left inguinal variety. The case of De Gouey,[8] of removal of a fœtus from a hernial sac, is, judging from the quaint and interesting account translated from the Sloane Manuscript, apparently an example of extra-uterine gestation, as the much-discussed case of Skrivan and Lumpe was finally decided to be. Other cases not included in previous statistics are those of Defontaine,[9] Legueu,[10] Rouffart,[11] and Diederich,[12] abstracts of which follow.

The unimpregnated uterus may be congenitally herniated, or the accident may occur in early life, or during or after the child-bearing period, usually when the pregnancies have been multiple and numerous; and the uterus may become impregnated in this condition. The pregnant uterus may also

enter a pre-existing hernia and pregnancy go on until the full term.

The etiology, symptomatology, and diagnosis of this condition have been given at length in the articles quoted, and it is unnecessary to dwell upon all of them. There are, however, several points suggested by the history of our case which are of interest. She was the mother of three children. Multiple pregnancies are an important predisposing factor to hernia of the womb. She had had a small, right inguinal hernia all her life, probably a congenital hernia, and perhaps of the ovary. The presence of a pre-existing hernia is a predisposing factor, and an ovary may be in the sac, and by its traction on the uterus, especially when adherent to the sac, and the latter is increasing in size, aid in drawing the uterus outward. In a relatively large proportion of these cases there are congenital anomalies present, as a rudimentary uterus, bicornute uterus, congenital hernia, imperforate vagina, pseudohermaphroditism, shortening of the round ligament, associated with increased liability to uterine hernia. In pre-existing hernia the sac probably often enlarges at the expense of the broad ligament on that side, making direct traction on the womb. The only organs in the sac were the uterus and its ligaments, the right ovary and tube, and part of the left tube. Both ovaries may accompany the uterus in its excursion, usually only one, that of the side on which the hernia is located. There was no omentum present, adhesion of which to the uterus might have caused its displacement by traction (Chopart's case). The patient was washing clothes when the accident occurred, probably bending over and exerting herself more than she acknowledges. Severe sudden exertion, causing increased intra-abdominal pressure, is an important exciting cause. It is a curious fact that both of Lallement's cases occurred in washerwomen. The uterus was probably practically strangulated, a unique accident. It was necrotic, splitting open under manipulation and discharging pus from its cavity. The microscopic examination also showed inflammatory changes in the tissues of the uterus.

Diagnosis.—No suspicion of the true nature of the contents of the hernia was entertained before operation. The diagnosis made was of probable omental hernia, from the absence of symptoms of intestinal obstruction. The presence of a pyriform mass, hard, perhaps irreducible, would be consistent with the presence of the uterus, and in some cases a smaller round or ovoid movable body alongside of it, the ovary, has been described, and a correct diagnosis arrived at. A vaginal examination before operation would have revealed an absence of the uterus from its normal position, and a change in the direction of the cervix and vagina. As Eisenhart points out, the introduction of a sound is difficult. A painful swelling of the herniated uterus during menstruation has been described. In pregnancy occurring in a herniated uterus, or in one horn of a bicornute uterus, the usual objective signs of pregnancy may be elicited as pregnancy progresses, the uterus meanwhile steadily increasing in size.

Return of the uterus would have been indicated had its condition permitted, but under the circumstances there was no alternative but hysterectomy. The left ovary was not prolapsed, and its removal was unnecessary. Conservation of the pelvic organs as far as possible, at least where functionating, would seem to be indicated.

In addition to the case here reported, operations for hernia of the non-pregnant uterus have been done by Leopold, Schwartz, Brohl, Krug, Defontaine, Legueu, Rouffart, and Diederich. Leopold [13] successfully excised one horn of a bicornute uterus, with the tube and ovary, from an inguinal hernia. There was an imperforate vagina in his case, as there was also in Schwartz's [14] case, in which there was a double congenital hernia, with failure of union of Müller's ducts, the right hernia containing a "uterus in miniature," which was replaced, the left containing a muscular cord, which was excised. The patient recovered.

Brohl's [15] case was a pseudohermaphrodite of the female sex, thirty-six years old, with a left inguinal hernia of six years' duration, which was correctly diagnosed before opera-

tion to contain the uterus and ovary. He amputated the uterus and both ovaries, one of which was rudimentary, and fastened the stump to Poupart's ligament to close the canal. The uterus was bicornute. This patient also recovered. His treatment of the stump was practically the same as that followed in our case.

Krug [7] operated on a left inguinal hernia of the uterus and ovary, congenital, the uterus reducible, the ovary adherent, in an unmarried girl aged nineteen years. The hernia had existed as long as she could remember; symptoms for five months only. A correct diagnosis of the contents was made before operation. The sac was apparently formed from the left broad ligament, explaining the irreducibility of the ovary, which was adherent to it. The uterus was reduced, the left tube and ovary removed, and the sac excised; closure by the McBurney method. The patient died fifteen days after operation, apparently of an intense anæmia, with cardiac degeneration; no sepsis. Post-mortem examination showed the right broad ligament exceedingly long, running behind the posterior surface of the uterus, so that the right tube and ovary were on the left side of the uterus.

L. Defontaine [9] performed radical cure on a hernia, left inguinal, existing for five months, in a child aged seven months. It contained the uterus and both ovaries, being complete of the uterus, and the contents were returned to the abdomen after digital divulsion of the rings.

Legueu [10] reports a case of left inguinal hernia in a girl of eighteen years, congenital, and containing the uterus, which was very small, one ovary, and both malformed Fallopian tubes, one ovary being wanting. The vagina was imperforate. He operated, reduced the organs into the abdomen, and the patient recovered.

Rouffart [11] reports a case in a girl aged twenty-two years, with congenital hernia, which for three weeks had been very painful and sensitive. The vagina was imperforate, the other sexual characteristics well developed. On operation the uterus was found rudimentary, apparently unicornute, adherent to the

sac, the left tube and ovary in the abdomen, the right absent. These organs were removed, and the patient recovered. It may be noted that this case is an exception to the almost universal rule that at least one ovary is present in the hernia with the uterus.

Diederich [12] reports a case similar to Rouffart's, in a girl of twenty-one years, also with imperforate vagina, in which the rudimentary uterus, with the left ovary and tube, was removed. The right adnexa were not discovered.

The frequent association of imperforate vagina with a rudimentary congenitally herniated uterus in the cases reported in recent literature is of interest. It is probable that the more frequent performance of operations for radical cure has revealed cases of this nature which were previously assumed to be herniæ of common types.

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SUTURE OF THE BRACHIAL ARTERY.

BY GASTON TORRANCE, M.D.,

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On December 21, 1903, John Roberts, white, aged seventeen years, while working in the mines, had his left arm badly crushed about midway between the elbow and shoulder by the wheels of one of the cars. The muscles on the outer side of the arm were badly lacerated, exposing the bone, and the coal-dust was so deeply ground into the tissues that it was impossible to remove it. He was brought to St. Vincent's Hospital late that afternoon. A wet dressing was applied by the resident. I saw him the following morning. His temperature was then above 103° F. I introduced a small rubber tube on the inner side of the arm and put on a constant irrigation of bichloride 1 : 4000. The fever immediately began to subside, and at the end of a week the wound was perfectly clean and the irrigation was discontinued.

On December 28 the arm began to bleed profusely. The Sister in charge of the ward applied a bandage firmly just below the shoulder, and controlled the hæmorrhage until he could be brought down to the operating room, where I saw him at once. Upon opening the wound, the artery showed a funnel-shaped ulcer which had perforated, the opening being about as large as the point of a pencil, and at every pulse-beat the whole of the blood stream was forced out through this opening. There was no sign of a radial pulse, and the arm was cold and œdematous, and of a dark color.

My first impulse was to catch up the artery with a pair of forceps and ligate it, but, remembering Dr. Crile's work on temporary ligature of blood-vessels, I decided to try to suture the wound, trusting that the blood had not clotted in the distal end. While waiting for the instruments and suture material, the hæmorrhage was controlled by pressure. My first suture was introduced with the arm extended, but tore out when tied, and I saw that it would be necessary to flex the arm and keep it in that position.

I used a small, full-curved intestinal needle with fine silk, introducing it as a purse-string, and upon tying it found that it completely controlled the bleeding. Only one suture was used. A portion of the muscle was dissected up and grafted over the sutured portion of the artery. A dry dressing was applied, and the arm put up in a right angle external tin splint. The hand was slightly elevated and placed on a large hot-water bottle. I could not find the radial pulse when the operation was finished. I saw him again about five hours later, and the radial pulse was as strong as in the other arm, and the puffiness had left the arm, which was now warm and normal in appearance.

A close watch was kept day and night for a week in case the suture should give way.

He was kept in bed about two weeks, and the arm was kept in the splint for two months.

The muscle graft grew over the artery firmly, and could be watched for several weeks before the skin-flaps covered it over.

The wound has healed up perfectly over the sutured artery, and he is beginning to use the arm some.

PYÆMIC GLANDERS IN THE HUMAN SUBJECT.

REPORT OF A RECENT CASE OF LABORATORY ORIGIN TERMINATING IN RECOVERY.

BY J. CLARK STEWART, M.D.,

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Professor of Principles of Surgery in the Medical Department of the University of Minnesota.

THIS case occurred in one of the assistant bacteriologists of the Minnesota State Board of Health, and was due to accidental infection while working upon material from two fatal cases of human glanders which occurred near Perham, Minnesota.

Dr. McD., aged twenty-seven years, previously in perfect health, had been working with this material for some weeks when she became slightly indisposed, and after a few days was compelled to go to bed with symptoms resembling typhoid fever. On Saturday afternoon, June 21, she had malaise, and in the evening noticed a headache and slight backache. After about an hour's sleep she was awakened by darting pains through the back and lower extremities. The pains steadily increased in severity and extended in less marked degree to the chest and arms. The feet and legs were cold, but no chill or chilly sensations were experienced. The body and head felt very hot and dry, and the pains persisted for about twelve hours. Sometime during the first twelve hours a pain was referred to the region of the diaphragm, which persisted for about five days, and was aggravated by respiratory movements. During the first few hours of the attack nausea was present, but there was no vomiting at any time. There was heavy sweating during the afternoon and night of the second day, which at first was thought due to the administration of salicylates, but it continued to a marked degree during the first two weeks of the illness. The temperature when first taken, about six hours after onset of the pains, was 102.8° F. In six hours more it reached 104.5° F., and it then receded, being at 4 P.M. on the second day 103° F.; at 9 P.M. 102.8° F.; at 8 A.M. on the third day 100.5° F.; at 7 P.M. 100° F.; on the fourth day at 8 A.M.

98.8° F. The patient remained in bed two days, and on the morning of the fourth day got up (temperature normal), walked several blocks and remained up all day. In the evening the temperature was found to be 102.8° F. On the evening of the seventh day an oval œdematous swelling about two inches long appeared at the right wrist over the region of the ulnar nerve, which was quite sensitive to pressure. Another less prominent swelling was present in the left arm at the outer border of the biceps, extending downward from midpoint of biceps about three inches, the width being about three-fourths of an inch, and this was also extremely sensitive to pressure. Deep in the calf muscles of the right leg was a third tender region two or more inches in length, which could not be definitely outlined.

On the eighth day the swellings were more prominent, especially the one on the wrist over which the skin was slightly reddened. This redness had disappeared on the ninth day when the patient was first seen by me. There was then marked induration about the original point of the swelling in the left arm, and the right calf was noticeably fuller over the inner aspect. Blood count (Dr. White) showed 8500 leucocytes.

On July 8, I incised the swelling at the right wrist under local anæsthesia and opened a cavity, evacuating about a drachm of purulent material which seemed surrounded by an albuminous covering, so that it came out like the yolk of an egg surrounded by the white. The cavity was then packed with iodoform gauze after mopping it and the skin incision with 95 per cent. carbolic followed by alcohol.

Cultures (Dr. Beckmann) from the pus removed gave a pure growth of Bacillus mallei, and several guinea-pigs inoculated intraperitoneally with two cubic centimetres of a broth emulsion of the pus died in from twenty-four hours to four days.

The organism recovered at this time seemed slightly less virulent than that from the cases from which the inoculation occurred.

After this, the treatment of the other swellings in the left biceps muscle and in the calf of the right leg was considered; operation upon these was postponed to allow time for encapsulation, because the fever seemed to be dying out and no other lesions were appearing, and also to determine whether new lesions would appear as the result of the opening of the first focus. On July 22 an attempt was made to dissect out the bicipital focus intact

without opening the abscess, but this failing, the wound was filled with 95 per cent. carbolic, through which the pus was allowed to escape and mopped away, when the wound was filled with alcohol and dried and packed with iodoform gauze.

This focus was situated entirely within the biceps muscle and had destroyed quite an extent of the muscular fibres.

In the leg a careful dissection was made from behind through the calf dividing the gastrocnemius and soleus in the middle line, and the abscess cavity was found between the soleus and the deeper muscles apparently formed at the expense of the latter. In this case the large wound was filled with 95 per cent. carbolic and the abscess incised through this, and after removal of the pus the muscles and skin were sutured, leaving only a central opening for packing the abscess cavity. At the same time the original wound at the wrist was curretted and carbolized.

All the wounds healed kindly without any skin infection, but it was over two months before healing was complete.

Cultures (Dr. Beckmann) from all the foci at the time of the operation showed virulent pure growths of Bacillus mallei, and one week later the dressings from all the wounds showed the bacilli, but in very small numbers.*

On August 5, an inflamed lymph node was enucleated from the left submaxillary region, it having been tender and swollen for only about four days, and within this was a purulent focus containing virulent Bacilli mallei. This wound was carbolized. During this time the fever had been quite constant, but varying widely, with an afternoon rise from 100° to 103° F. Ten days after the removal of the last focus the temperature dropped to normal, and remained so with slight occasional exacerbations until September 22, when after attempting to do a little work at the laboratory she had a slight chill, headache, backache, and malaise, with some purpuric spots on abdomen and legs, and temperature ran up to 103.5° F. After three days the temperature rapidly dropped to normal and remained normal and subnormal for three days until Septem-

* A full account of the bacteriological findings in this case, and also in the two from which the infection arose, with the details of the work done on them in the Laboratory of the Minnesota State Board of Health, Dr. F. F. Insbrook, Director, can be found in his annual report for 1903–1904.

ber 28, when after walking several blocks the temperature again rose without a chill to 104° F. in the afternoon, and remained high (above 103° F.) until October 2, when it began to subside, reaching normal the next day. During this attack of pyrexia a second purpuric eruption appeared scantily over the limbs and abdomen. October 7, the temperature again rose gradually and dropped to normal on the 10th, remained below normal three days, after which time there were no marked exacerbations, but a quite regular afternoon rise to 99½° and 100½° F., which persisted until the latter part of May, 1903.

During the febrile attacks there were no local symptoms except a heavy feeling and ill-defined pain near the insertion of the diaphragm upon the vertebral column. There was never any definite tenderness anywhere in the abdomen, but only an ill-defined discomfort behind the stomach to the left side, not associated in any way with the taking of food.

At the time of the first pyrexial attack all the wounds were solidly healed except a small sinus in the left arm, and this healed during the persistence of high temperatures.

After this the patient's general condition improved, and she seemed well except for the slight afternoon rise. She spent the summer out of doors and in the fall seemed as well as ever. She has since had no fever nor any symptoms pointing to a persistence of the infection.

This case seems worthy of record from its most fortunate termination and the extreme rarity of laboratory glanders. Certain points seem of especial interest.

First, its origin from two cases of most virulent pyæmic glanders in young men owing their infection to contact with diseased horses. Both cases began with symptoms resembling typhoid fever, rapidly passing into those of sepsis. Both died on the seventeenth day with multiple abscesses in the skin and subcutaneous tissue, the skin lesions being so numerous as to excite the suspicion of smallpox.

Second. The incubation period in Dr. McD.'s case was six days, figuring from the only known chance of infection, she having made an autopsy upon an inoculated guinea-pig on

June 16, and having at that time a small open wound on her finger.

Third. The absence of the lesions of the skin and mucous membranes which are so common in most cases of glanders, and the limitation of the original foci to the voluntary muscles.

The points aimed at in the surgical treatment of the case after an exact diagnosis had been made, were, first, delay in hopes that the foci might become encapsulated by inflammatory changes in the surrounding tissues, and that the patient might become as far as possible immune by the manufacture of her own mallein. Second, the avoidance of local implantation of Bacilli mallei upon wound surfaces when foci were eradicated.

Several methods aiming at the prevention of inoculation were suggested, including the actual cautery; but the use of 95 per cent carbolic and alcohol on all the cut tissues before exposing them to pus contact proved entirely satisfactory in preventing further local lesions, and allowed the wounds to heal promptly except where the packing and anatomical conditions favored the persistence of a sinus.

It is difficult to account for the train of symptoms arising after all the wounds were practically closed. The repeated attacks of high fever, general prostration, aching, etc., with purpura, certainly suggested some internal glandular focus, but the subsequent complete though tardy recovery would seem to negate this view.

The medical and surgical treatment used throughout was an attempt to meet as far as known the theoretical conditions present, and that it was successful is a matter of constant self-congratulation on my part and on the part of my colleagues in the Pathological Department of the University of Minnesota and the Minnesota State Board of Health.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting, February 24, 1904.

The President, HOWARD LILIENTHAL, M.D., in the Chair.

TRAUMATIC RUPTURE OF SPLEEN; SPLENECTOMY.

DR. IRVING S. HAYNES presented an Italian boy, nine years old, who, on December 28, 1903, at one o'clock in the afternoon, was run over by a light buggy, the wheel (or wheels) traversing his body from the splenic region to the left groin, and down between the legs.

On admission to the hospital the patient was in a condition of shock, but conscious. The abdomen was rigid and tender over the splenic and left inguinal regions, and the child complained of colicky pains. Upon admission, his temperature was 97.8° F.; pulse, 92; respirations, 26. After the administration of a saline enema, an ice-cap was applied to the abdomen, and the patient was stimulated with strychnine and whiskey. At 5 P.M. his temperature had risen to 100.3° F.; pulse, 104; respirations, 28. At 9 P.M. his temperature was 100° F.; pulse, 138; respirations, 40. At 1 A.M. his temperature was 98.6° F.; pulse, 140; respirations, 48. As the patient's condition was evidently growing worse, and evidences of internal hæmorrhage were more marked, an exploratory laparotomy was deemed advisable. Under chloroform anæsthesia an incision was made in the median line, a little below the umbilicus. The abdominal cavity was found filled with bloody fluid, which escaped on opening the peritoneum. The intestines

were hastily examined, but nothing found. As the child had complained of pain over the upper left quadrant of the abdomen, a second incision, four inches long, was made in the left semilunar line. On palpating the spleen, that organ was found to be ruptured, its entire anterior border being severed from the body of the organ with the exception of a very narrow pedicle. The severed section was about the size of an adult forefinger. The incision was enlarged by a right-angled cut running two inches to the left. The spleen was then loosened from its attachments and brought near the opening, with the intention of placing a row of mattress sutures parallel with the crushed surface and removing the torn section. As the organ was being carefully manipulated, and the pedicle held between the fingers, something was felt to loosen and slip. Fearing that a rupture of the blood-vessels was imminent, a clamp was at once placed upon the pedicle and the spleen cut away. A catgut ligature (chromic, No. 2) was then placed on the pedicle internal to the clamp, which was left in place as an additional safeguard. The child's condition being very serious, a saline enema was administered and hypodermic stimulation was freely resorted to. The abdominal wounds were rapidly closed with through-and-through silkworm-gut sutures.

On the first day after the operation the temperature reached 101.6° F.; pulse, 132; respirations, 52. Free stimulation and saline enemas were resorted to. During the day the child vomited some brownish fluid. On the following day the temperature reached 102° F.; pulse, 138; respirations, 40. On this day the patient vomited a bright green fluid. The clamp was removed. On the third day the temperature fell to 100° F.; pulse, 136; respirations, 38. Saline and nutrient enemas were continued. The patient had three stools. The urine was normal. From this time on convalescence was uneventful until the twentieth day, when the temperature suddenly rose to 106.2° F.; pulse, 152; respirations, 32; this followed a distinct chill during the night. A physical examination of the chest revealed slightly roughened breathing sounds. This soon cleared up, and the temperature fell to normal within twenty-four hours. The patient was discharged cured on January 31, 1904.

The following was the result of blood examinations made by Dr. Krauskopf:

January, 1904.	White Cells.	Red Cells.	Hæmoglobin, Per Cent.
3	20,600	4,800,000	85
5	18,600	4,700,000	85
7	17,600	4,950,000	90
9	16,000	4,800,000	95
11	20,000	5,000,000	100
14	18,000	5,000,000	100
31	18,000	5,000,000	100

Urine, normal.
Fæces, normal.

PERFORATED GASTRIC ULCER.

Dr. Charles H. Peck presented a man, aged twenty-three years, who was admitted to Roosevelt Hospital, in the service of Dr. Robert F. Weir, at 5 A.M., January 10, 1904. A diagnosis of perforated gastric ulcer had been made by the ambulance surgeon. This was confirmed by the house surgeon and the operator, and an immediate operation was performed four hours after the onset of acute symptoms of perforation.

The patient's history was as follows: Measles in childhood, pneumonia three years ago. For two years the patient has been troubled with indigestion; after eating he would have severe abdominal pain, knife-like in character. He frequently vomited soon after eating; sometimes the pain was so severe that he irritated his pharynx and made himself vomit; he had never vomited blood, nor passed blood by the bowels. Five months ago he was in Bellevue Hospital for a week for his pain after eating. Was told it was imaginary and sent home.

Present Illness.—Last night at nine o'clock he ate a light supper, as he did not feel well; had some abdominal discomfort. He went to bed about twelve o'clock, and about two hours later he was awakened by a terrible sudden cramp in the stomach; he cried out in agony, and felt a desire to defecate. He felt terribly weak and prostrated; the pain continuing, he drank a lot of water, which he soon vomited; it was bloody; two hours later the ambulance was sent for and he was brought to the hospital.

On admission his temperature was 98.4° F.; pulse, 124; respirations, 28. There was marked general tenderness over the entire abdomen, with extreme rigidity, both tenderness and rigidity being greatest in the epigastrium. No loss of liver dulness was noted; distention was very moderate; face pale, drawn, and anxious.

Operation at 6 A.M.; ether. A four-inch median incision above umbilicus; on opening peritoneum a quantity of gas and some turbid serum escaped. Pyloric end of stomach was pulled into view, and a perforation about one-fourth inch in diameter exposed on anterior aspect of pylorus, from which gas and fluid were escaping. Stomach wall for some distance around perforation was much thickened and infiltrated, the cystic duct and pylorus being matted together in the inflammatory mass. The perforation was buried with three tiers of continuous Lembert sutures of black silk, with some difficulty on account of infiltration of tissues. Escaped stomach contents and turbid serum bathed the entire peritoneal surface except lesser cavity; a considerable quantity was present in the pelvis and in both flanks, also between liver and diaphragm. Thorough flushing with a Blake tube and salt solution until fluid returned clear; a cigarette drain then placed down to suture line in stomach wall and the rest of wound closed by layers.

Course.—Temperature rose to 102° F. after operation, then gradually fell, remaining below 100° (rectum) after the third day; pulse, 130 after operation, dropped to 80 on third day and remained normal. The day following the operation he vomited a few times, the vomiting at one time being projectile in character; his bowels were moved by enema thirty hours after operation, and the vomiting soon subsided. Saline enemata and later nutritive enemata were given for the first three days. Hot water by mouth on the second day, milk up to four ounces every two hours on the third day. Solid food was commenced on the eighth day and increased gradually. Sat up on the nineteenth day and left the hospital well on February 1, the twenty-second day after the operation.

DR. PECK also presented a man, aged twenty-two years, who was admitted to Roosevelt Hospital, in the service of Dr. Robert F. Weir, early in the evening of January 21, 1904.

The probable diagnosis of perforated gastric ulcer was made by the house surgeon. His history was as follows: He had been troubled with pain in left inguinal region and outer and anterior aspect of thigh for some months, and had been under treatment for it. Was never troubled with indigestion until about three weeks before admission, since when he has had pain after eating and occasional vomiting. He worked as usual on the day

of admission until 4 P.M., when, after lifting some heavy glass, he was suddenly seized with severe cramps in the abdomen. He was obliged to stop work immediately and went to a neighboring saloon, where he was given a drink of brandy. He vomited it in a few minutes, and the pain became so violent that he laid on the floor and rolled in agony; the ambulance was sent for at once.

On admission his temperature was 102.2° F.; pulse, 124; respirations, 28. Leucocyte count, 16,000. There was marked general tenderness and rigidity over entire abodmen, somewhat greater above umbilicus, but not distinctly localized. The greatest pain was in left inguinal region and upper, anterior aspect of thigh, the old location. There was almost complete loss of liver dulness, and flatness in both flanks, which changed its level as patient was turned from side to side. No distention. Cardiac and pulmonary signs normal; general condition good.

Operation at 10 P.M.; ether. A four-inch median incision above umbilicus. Gas escaped on opening peritoneum, with some turbid serum. Flakes of lymph seen on anterior surface of stomach and under surface of liver, as well as on surrounding peritoneum. The anterior surface of the stomach was lightly adherent to the under surface of the liver by recent lymph; when separated by the hand, a perforation in the anterior stomach wall, about 1.5 to two inches from pylorus and midway between greater and lesser curvatures, was seen; it was about one-fourth inch in diameter, and gas and stomach contents escaped; the stomach wall around it was much thickened and indurated for a radius of one inch or more. The opening was closed with two tiers of black silk continuous Lembert stitches. The entire abdominal cavity was then irrigated thoroughly with a Blake tube and salt solution, and considerable turbid fluid washed from flanks and pelvis and subdiaphragmatic region. A single large cigarette drain was placed down to suture line, and the abdominal wall closed by layers except at this point, no attempt being made to drain peritoneal cavity. The usual dressing of moist bichloride and dry gauze; time, 50 minutes; condition good.

Course.—Vomited twice while coming out of ether; not at all afterwards. Temperature ranged from 100.6° to 102.2° F. during the first three days, gradually falling to 100°, the pulse ranging from 136 down to 108. Saline enemata were given for the first day; hot water by mouth in small quantities during the second

day. Bowels moved by enema on second day. On January 24, the third day after operation, his temperature suddenly rose to 103.4° F.; pulse, 140; he was very restless, and coughed a good deal. The wound was dressed and showed no signs of infection; the abdomen was soft and the leucocyte count 9000. From this time on convalescence was uneventful, the temperature remaining below 100° F. and pulse below 90 after the fifth day. The drain was removed on the fourth day and all drainage left out after the sixth day. Milk and lime water by mouth commenced on the fourth day, soft diet on the eighth day. Sat up on February 10, nineteen days after operation, and left the hospital well on February 13, twenty-two days after the operation.

STRANGULATED HERNIA, WITH RESECTION OF THE INTESTINE.

Dr. Peck presented a man, aged forty-seven years, who was admitted to Roosevelt Hospital, in the service of Dr. Robert F. Weir, January 17, 1904. For twenty years the man had had a reducible right inguinal rupture. He wore a truss at intervals, and at times the hernia would disappear for a year or more and be apparently cured, until some strong exertion brought it down again. Six months ago it was irreducible for two days. Patient never had any very serious illness. He is a moderate user of alcohol.

Present Illness.—Eight days before admission, the rupture came down and could not be reduced. It had gradually become more and more tender and painful. Five days before admission he began to vomit with increasing frequency, and for two days could retain nothing whatever.

His vomitus had never been fæcal. His bowels had not acted for five days and the abdomen was somewhat distended. His general condition was fairly good. Locally, there was an oblique, irreducible, tender, tympanitic, inguinal hernia the size of a goose-egg (on the right side). Skin not discolored over it. There was a distinct impulse on coughing, which suggested that the hernia was obstructed, not strangulated. The right testicle was not in the scrotum.

Operation, four hours after admission by the House Surgeon, Dr. Whittemore. Ether. Incision as for ordinary Bassini. The

tunic of the undescended right testicle (which lay just outside the inguinal canal) was first opened by mistake. On opening the sac a small amount of turbid fluid escaped and a loop of small intestine, four inches in length, of very dark color and slightly coated with lymph, was disclosed. After dividing the constricting band and drawing down the loop, the major portion of the gut slowly regained its color. An area about the size of a dollar at the point of constriction, however, did not recover, and after waiting ten minutes a resection was decided upon. In order to get normal intestine for approximation, about eight inches were resected. The ends were united with a medium-sized Murphy button in the usual manner, reinforced all around with continuous Lembert sutures. In order to return the button to the abdominal cavity, it was necessary to divide the internal oblique and transversalis for about an inch at their origin from Poupart's ligament. The button was left just inside the ring, and a single cigarette drain placed, leading down to it. The wound was closed, as far as practicable, according to Bassini.

Postoperative Course.—No vomiting after operation. Several enemata of saline were given for thirst in first twenty-four hours; then water was given by mouth and soon afterwards milk. At the end of sixty hours an enema was returned with a fair amount of fæcal matter. Wound dressed on fourth day and a narrow gauze tape substituted for cigarette drain. Wound closed rapidly. A cathartic was never given, his bowels remaining open with the aid of an occasional enema. Patient was kept on "soft diet" until after the escape of the button. On the nineteenth day an X-ray picture located the button in the upper pelvis, but it could not be felt, nor did high enemata bring it away. It was discharged spontaneously on the twenty-fourth day. Discharged, cured, on February 14, the twenty-eighth day after operation.

CONGENITAL DEFORMITY OF THE RIGHT LOWER EXTREMITY.

Dr. Royal Whitman presented a female child, three years of age, with a congenital defect of the right lower extremity, the fibula on that side being entirely absent. As a result of this defect, there was considerable shortening, and, in order to remedy this, a surgeon who had seen the patient soon after birth had shortened the other limb by removing a section of the femur. The remedy

did not prove effective, however, for, as in all cases of this type, the shortening had been progressive, amounting at the present time to two and one-half inches. The chief interest in the case was the remedy that had been employed.

FRACTURE OF THE FEMUR PRODUCED BY AN OBSCURE LESION OF THE BONE.

Dr. Whitman presented a young man, who came to the Hospital for Ruptured and Crippled a few weeks ago, with a resistant enlargement of the upper third of the right thigh, and about one inch shortening on that side. He stated that up to four months ago he was perfectly well. Then, without apparent cause, he began to have some pain about the right hip. This pain was severe enough to keep him in the house. About a week after its onset he accidentally kicked a chair, and immediately fell to the floor. The leg was entirely useless, and he was obliged to remain in bed for about a month. He was then able to go about the house with the aid of two sticks, and three weeks later he began to go out. In the meantime, an enormous swelling had developed over the upper part of the thigh, and when the patient was first examined the case was regarded as one of sarcoma of the femur, with spontaneous fracture. Since then, however, the swelling, instead of increasing, has become somewhat less. An X-ray photograph was taken, which showed that the fracture had occurred in the neighborhood of the trochanter minor. There was moderate outward rotation of the limb, firm union, and the patient walks about without discomfort.

Dr. Whitman said the only way he could account for the course of events in this case was that the weakness and subsequent fracture of the bone were due to the presence of a congenital cyst or to a mild form of osteomyelitis. The swelling he attributed to the deformity and exuberant callus resulting from improper apposition of the fragments. The speaker said he had never seen a parallel case.

Dr. F. Kammerer said he did not think the diagnosis of sarcoma could be absolutely excluded, because the growth had lately decreased somewhat in size. It was still rather large to be attributed to exuberant callus. In answer to a question of the President as to the nature of the growth in the bone (femur) of a case he had shown at the meeting of the Society some months ago

(ANNALS OF SURGERY, January, 1904), the speaker said that on cutting down upon the femur he found a hard, fibrous mass occupying the entire medullary canal. It extended from the trochanter down to the condyles at the knee, and, after chiselling open the whole bone, the mass could be removed in large pieces. The pathologist reported that the growth was purely fibrous in character. There had been no evidences of a recurrence, and since the operation the bone cavity was gradually filling up with granulation tissue. The deformity had increased, and a secondary operation would be necessary to correct it. Sarcoma and syphilis must be excluded. The case was certainly a very unusual one. Perhaps the further course might throw additional light on the etiology.

DR. WHITMAN said the X-ray picture apparently showed an overlapping of the short upper fragment. The callous formation was exuberant, but not more perhaps than might be explained by an untreated fracture. If the case were malignant in character, such a rapid union of the bone would be very unusual. The man gave no history of syphilis, and showed no evidences of that disease; and if syphilis could induce such fragility, it would also prevent union in all probability.

INTESTINAL OBSTRUCTION FOLLOWING OPERATION FOR APPENDICITIS.

DR. JOHN ROGERS presented a young man who was operated on for appendicitis about two years ago. On September 29, 1903, he committed some indiscretion in diet, and on the following day he vomited and passed some gas per rectum. On the following three days "bilious vomiting" continued, and the patient complained of some pain in the abdomen, but he was able to go about.

On the fifth day of the attack, when Dr. Rogers first saw him, the patient appeared fairly comfortable, but a little weak from lack of food. There were no abnormal physical signs. The mother stated that an enema had brought away some fæcal matter, and that gas had been passed. The urine was scanty. The patient's temperature was 101° F.; pulse, 125.

Because of the lack of physical signs, it was decided to postpone operative interference. During the next twenty-four hours the vomiting continued, and on the seventh day it had a fæcal odor. An exploratory operation was therefore decided on, although the belly was still perfectly soft; there was no distention,

rigidity, or pain. A median incision was made just below the umbilicus, and upon inspection a band was found starting at the cæcum, passing upward and inward along the free border of the omentum, and constricting the jejunum transversely at a point about two feet from its origin. After dividing the band, this underlying intestine presented a ring of gangrene about one-half an inch wide where it had been constricted, and it was therefore necessary to resect the gut at this point. The two divided ends were then brought together over a Murphy button. The patient made an uneventful recovery. The button was passed on the thirty-eighth day.

The case was interesting, Dr. Rogers said, on account of the total absence of any local signs of obstruction, and because of the small quantity of urine secreted during the patient's illness. On the last day of his illness he did not pass any urine This last symptom, Dr. Rogers said, had been noted in a number of cases where the obstruction of the intestines was high up. In addition to all this there is of course the interest attaching to the obstruction which followed, and seemed directly dependent upon the preceding operation for appendicitis. A subsequent obstruction seems a possibility, which, though remote, is unavoidable.

Dr. Charles L. Gibson said the question arose whether the adhesive bands were the result of an operation for appendicitis or were due to the primary condition. In the latter case, they should be regarded as an additional element of danger, and emphasized the importance of the prophylactic treatment of appendicitis by operating during the quiescent stage. The speaker said that personally he was inclined to believe that the bands were the result of the appendicitis, and not the operation.

Dr. Charles H. Peck said that very recently he saw a case of intestinal obstruction at Roosevelt Hospital following an operation for appendicitis. The operation, which was an interval one, had been done about a year before, and no drainage had been employed. The cause of the obstruction was an adhesive band constricting the ileum. The patient was in a very bad condition, and died from the effects of the operation. Dr. Peck said this was the only case he had seen where adhesive bands causing obstruction had followed an interval operation.

Dr. John F. Erdmann said he thought it was a question whether the band in the case reported by Dr. Rogers was a result

of the operation for appendicitis, or a pre-existing condition, and one of the causes that demanded the primary operation. The speaker said he had recently seen two cases of appendicitis where these bands were found, and where no previous operation had been done.

Dr. Peck said that in the case he had mentioned, the presence of the adhesive band had appeared to him to be a postoperative condition. He did not think it was present prior to the primary operation, although he was unable to make any positive statement on that point.

Dr. Ellsworth Eliot, Jr., said he had seen two cases of intestinal obstruction after interval operations for appendicitis, one six months after the primary operation, the other eight months. In both cases, the speaker said, he had done the original operation, and in one of them the secondary operation also. In the first case, which was followed by intestinal obstruction, the stump of the appendix was cauterized and dropped back, and when the abdomen was subsequently reopened to relieve the obstruction it was found that adhesions had formed to the stump of the appendix. Warned by that experience, Dr. Eliot said he had since inverted the stump; but in spite of that procedure, he had had one other case where obstruction occurred. One of his cases recovered. In the other, where the operation was done outside the hospital, the patient died. Dr. Eliot said he had heard of other cases where intestinal obstruction developed after an interval operation for appendicitis.

Dr. Lilienthal said he thought the method of inverting the stump of the appendix would invite the formation of adhesions, while simple cauterization of the stump would prevent them. In the latter case the little stump was cast off in a very few days, and with it any adhesions which might have formed. The speaker said he had had the opportunity of examining a number of those cases, and had reported his experience in a paper which recently appeared in the *New York Medical News*. He had never seen adhesions at the point where the appendix had been cut off and cauterized, and he regarded that method as safer and more rapid than the inversion method.

SOME REMARKS ON TUMORS OF THE CHIASM, WITH A PROPOSAL HOW TO REACH THE SAME BY OPERATION.

Dr. Otto G. T. Kiliani read a paper with the above title, for which see page 35.

Dr. Lilienthal said that in his capacity of chairman of the medical equipment committee of the new Mount Sinai Hospital he had investigated the subject of surgical engines, but the committee had not yet decided which one to purchase. He suggested that the handle of the instrument should be so constructed that it could be held steady, and every precaution should be taken not to lacerate the dura. With the old-fashioned instrument for cutting through the skull, the breaking of the cables caused a good deal of annoyance. In the drilling-engine used by dentists, a cord and jointed arm were substituted for the cable, and this gave much better satisfaction, because it was less likely to get out of order and was easily repaired. Dr. Lilienthal said that dentists had recommended, as the best surgical engine, one devised by Dr. Cryer, of Philadelphia, a dentist. It was expensive, but very powerful and adaptable.

Dr. Kiliani said that with the instrument he had described the fraise was of tempered steel, and cut so readily that extreme pressure upon the handle was unnecessary; in fact, it could be held almost as lightly as a pencil. There was little or no danger of injuring the dura.

Stated Meeting, March 9, 1904.

The President, Howard Lilienthal, M.D., in the Chair.

RESECTION OF KNEE FOR TUBERCULOSIS.

Dr. John A. Hartwell presented a negro, twenty-eight years old, who was admitted to the Lincoln Hospital in March, 1902, with the history of having had some trouble with the left knee, the condition having existed about a year. It began with pain, and went on to a typical case of tuberculosis of the knee-joint. When he first came under observation there was a large quantity of fluid in the joint and over the internal tuberosity of the tibia, and the suppuration had progressed to such a degree that the bone was almost exposed.

Upon opening the joint through a transverse incision, it was found that the lower end of the femur was more or less diseased, and about one inch of the bone was removed. In the tibia the disease had extended down into the medullary canal for a distance

of fully two and one-half inches, and, as a radical operation would have necessitated the removal of at least three inches of the bone, it was deemed advisable to resect only the articular end of the tibia, scrape out the diseased tissue in the medullary cavity, and then fill it with an emulsion of iodoform. All the tubercular tissue in the capsule and in the periarticular spaces was carefully cleaned away and the lower end of the femur and the upper end of the tibia were then sutured with chromic gut. The wound discharged freely for several weeks, but finally healed entirely with the exception of a small sinus, through which a piece of chromic gut was removed about a year after the operation. Ankylosis was complete, and the patient walked with a slight limp only. In reply to a question, Dr. Hartwell said there was an inch and one-half shortening on the affected side.

INGUINOPERINEAL HERNIA.

Dr. William B. Coley presented a man, thirty-eight years old, who was operated on in September, 1902, for this very rare variety of hernia, in which the testis and hernial sac occupied the perineum instead of the scrotum. At the time of the operation, the testis was considerably atrophied; it was transplanted into the empty scrotum, but, on account of the rather short cord, it could not be carried down into the bottom of the scrotum.

Dr. Coley said he had operated on five similar cases, in one of which the tumor was as large as a cocoanut. In three of his cases he had successfully transplanted the testis into the scrotum. All of these cases were on the right side.

FOREIGN BODY (WOVEN BOUGIE) IN RETROPERITONEAL SPACE.

Dr. Howard Lilienthal presented a woman, twenty-nine years of age, who was admitted to hospital on December 1, 1903. She had been married four years, had had one child and two miscarriages. The last abortion was said to have been self-induced on July 1, 1903, in the early months of pregnancy, by means of the introduction of a woven instrument. This woven bougie, previously boiled, and used only after the patient had washed her hands and taken a douche, was said to have been inserted into the uterus and left there. The next day there were cramps and some slight bleeding, one clot of considerable size being expelled. The instrument was not found after the abortion. Menstruation ap-

peared again in October, and again in November, there having been no appearance of blood in the meantime. For five weeks after the introduction of the bougie the patient was sick in bed with chills and fever, accompanied by profuse sweating and a throbbing pain in the left side from the pelvis to the ribs, and in the right loin. A swelling appeared soon after the miscarriage, occupying the left iliac region. It was quite tender to pressure. The patient had been out of bed since the 17th of August, but said that she had occasional fever and rapid pulse. She had lost twenty-two pounds in weight from July 1 to the date of her admission, December 1.

On examination, a hard mass, the size of a large fist, was felt occupying the left iliac region, and apparently adherent to the abdominal wall. From the upper section of this mass, a long, indurated portion extended upward, apparently along the posterior abdominal parietes, about in the direction of the ureter, until it was lost beneath the ribs. The entire mass was but slightly sensitive to pressure. Examination by vagina and by rectum did not indicate close relations with the pelvic organs.

The patient's general condition was very good, and there was little, if any, abnormality of pulse or temperature.

On December 5, under gas and ether anæsthesia, Dr. Lilienthal made an incision into the lower portion of the mass through the abdomen. After penetrating to the depth of about an inch into tough, indurated tissue, he decided to perform cœliotomy through the same external incision alongside of the tumor. Intra-abdominal palpation revealed the fact that the pelvic organs were perfectly free, and that the extension of the tumor upward along the line of the ureter was also absolutely free from adhesions with the viscera. Apparently the instrument had not passed through the uterus, but had been forced through the vaginal fornix, and had penetrated the retroperitoneal space. The original incision into the mass was now deepened for another half inch and he came upon a hard, cylindrical body, the bougie, lying perfectly free in a tube-like canal which it exactly fitted. On withdrawal, the instrument, which had lost its proximal capping and was therefore open, was found to be filled with a purulent fluid. The bougie was a No. 13 French, considerably the worse for wear. A rubber tube somewhat smaller than the bougie was inserted into the sinus for drainage, and the peritoneal wound closed by suture. Drainage was not satisfactory, and on December 19 the patient

was again anæsthetized and a counteropening in the loin made by cutting down upon a large-headed probe passed into the sinus. A viscus, thought to be the colon, was encountered, and had to be carefully incised in order to identify it. Finding it to be indeed the large intestine, the opening was closed by silk suture and counterdrainage by tube finally accomplished. The wound in the colon broke down, so that there was for a time a fæcal fistula, and the patient also passed through a severe tonsillitis and a lobar pneumonia. The drainage was efficient, however, and all wounds closed by February 15, the patient being discharged well after a stay of two and one-half months in the hospital.

CHOLECYSTECTOMY.

Dr. F. Kammerer presented a man, twenty-nine years old, who was perfectly well until a month before the operation. He then began to complain of severe pain in the epigastrium, with chills and vomiting. He had three similar attacks during the month, the last just before his admission to the hospital, this time associated with pain in the back and shoulder. Examination showed a large tumor over the site of the gall-bladder, with all the symptoms of an acute inflammatory condition.

The gall-bladder was exposed by Robson's incision. It was found much enlarged and filled with stones. The omentum was adherent to it, especially around its tip. At this point, after separation of the adhesions, which was easily accomplished, a patch of gangrene about the size of a silver quarter was found, and in the centre of this a perforation large enough to admit an ordinary lead-pencil.

The gall-bladder and part of the cystic duct completely filled with stones were removed. Recovery was uneventful.

Dr. Kammerer presented a second patient, a woman, fifty years old, who had had several attacks of biliary colic during the past two years. At the operation the gall-bladder was found filled with stones considerably thickened and tied down by numerous adhesions. It was freed with considerable difficulty, and extirpated. A search of the common duct was then made for further stones. Palpation of the deep ducts did not reveal the presence of further stones, and a probe was passed through the cystic and common ducts apparently without encountering any resistance.

The patient recovered from the operation, but a biliary fistula remained, all attempts to force the bile into the intestinal tract

failing. Upon reopening the abdomen several months later at least half a dozen stones were found in the common duct, which was slit open in its entire length. Just above the papilla there was a mass of inspissated bile about the size of a finger-nail.

After suturing the common duct, the stump of the cystic duct was opened and drained through the old wound. Unfortunately, the sutures in the common duct gave way, and for a long time there was a discharge of bile through the new incision. After four or five months both wounds finally closed.

Dr. Kammerer said that in this case the stones in the common duct were evidently overlooked at the first operation, in spite of a fairly thorough search and probing.

PRIMARY CHOLECYSTECTOMY: SCOPE, METHOD, AND RESULTS; CONCLUSIONS FROM FORTY-TWO CASES IN THE PRACTICE OF THE AUTHOR.

Dr. Howard Lilienthal read a paper with the above title, for which see page 44.

Dr. Charles L. Gibson said it was scarcely four years ago when he presented the first case of primary cholecystectomy that had ever been shown at a meeting of this Society, and at that time Dr. Lilienthal rather opposed the operation. Since then, apparently, he had gone almost to the other extreme, and the tone of his paper was so optimistic that it gave one the impression that cholecystectomy was not only as safe, but safer than ordinary cholecystotomy. If that interpretation of Dr. Lilienthal's paper was correct, Dr. Gibson said he would take issue with him. He did not regard the actual removal of the gall-bladder as innocuous an operation, or less so, than one consisting of simple drainage of the gall-bladder. Theoretically, cholecystectomy possessed the advantage of removing the focus of infection, of doing away with the possibility of a mucous or biliary fistula, and of a recurrence of pain due to adhesions. A persistent fistula after cholecystectomy meant an incomplete operation.

Under certain conditions, Dr. Gibson said, the operation of cholecystectomy was certainly indicated, but it should not be undertaken unless some definite object was to be accomplished by it. Simple drainage of the biliary passages could be done perfectly well by cholecystectomy without opening the lower duct, by leaving the cystic duct open.

The reader of the paper mentioned hæmorrhagic diathesis as

a contraindication to the performance of cholecystectomy. While this was so theoretically, it would also apply to cholecystotomy. The speaker said he had seen two patients succumb to hæmorrhage after simple drainage operations on the gall-bladder.

Dr. Willy Meyer said that during the past twelve years, when he first took up gall-bladder surgery, he had done more cholecystostomies than cholecystectomies, and the results of the former operation, so far as a recurrence of the colicky pains, etc., was concerned, were extremely satisfactory. On two occasions he had opened the gall-bladder, taken out the stone, and immediately closed the wound. In both of those cases the patients got well, but the speaker said he did not favor the operation. At present he was also opposed to the performance of cholecystectomy in every case of gall-stones. He recalled two instances where the operation was followed by a recurrence of the colicky pains; there was no recurrence of the jaundice, but the pains were more severe than he had ever seen after cholecystostomy, and were attributed to the formation of adhesions. In every case, however, where the gall-bladder was thickened or materially changed in appearance, it ought to be removed. The speaker recalled a case where he had operated for acute empyema and did not add extirpation of the bladder on account of the patient's serious condition. Recovery was uneventful. Three months after the wound had definitely closed, a small, hard nodule was noticed in the scar, which at once impressed him as being malignant in character. A carcinoma of the abdominal wall developed, which evidently had begun in the wall of the gall-bladder. Patient was later operated by another surgeon and died soon after.

Dr. Kammerer said that during the past fourteen years, since the publication of Courvoisier's classical work, he had been operating on cases of cholelithiasis, and had never seen a case of recurrent gall-stones. When changes in the gall-bladder were found at operation, a primary cholecystectomy was indicated, as Dr. Meyer had already stated, because it was a well-established fact that patients with carcinoma of the gall-bladder generally had gall-stones. The macroscopic diagnosis of carcinomatous degeneration of the gall-bladder or of the ducts during operation was frequently impossible, and it was, therefore, better in such instances to remove the organ, when the appearance of the latter was not normal. Personally, the speaker said, he was opposed to primary cholecystectomy in every case.

Dr. George E. Brewer said that Dr. Lilienthal, in his paper, did not advocate removal of the gall-bladder in every case of cholelithiasis, and the indications he gave for removal of the organ were very definite. Dr. Brewer said he would go even a step farther than the reader of the paper and advise the extirpation of every gall-bladder that had been rendered functionless, or the walls of which were thickened or changed in appearance, or one in which the cystic duct was obstructed. Another indication for removal of the gall-bladder was where a stone was found impacted in the pelvis of the organ, because mere removal of the stone in such a case usually resulted in absolute stricture. A gall-bladder containing purulent fluid should always be removed; otherwise, an infected cavity was left which would later cause trouble. Dr. Roswell Park had made the assertion that we should remove the gall-bladder as we would the appendix; that, like the latter organ, it was a relic, and of no particular use to the individual. Dr. Brewer said that where we had a gall-bladder which was not in direct connection with the duct system, or which was the seat of inflammation, it ought to be removed. If there were any indications for removal of the gall-bladder, it should be done at the primary operation. A secondary cholecystectomy was difficult, and the operation should be compared, in difficulty, to a secondary nephrectomy after suppurative disease of the kidney.

Dr. John B. Walker said that he also had seen two fatal cases from persistent oozing after operation on the gall-bladder. The speaker agreed with Dr. Lilienthal that in those cases where the gall-bladder was in a gangrenous condition the cystic duct should *not* be closed.

Dr. L. W. Hotchkiss said that personally, in his work on the gall-bladder, he had been rather conservative in the choice of cases for removal of the gall-bladder. He spoke of the desirability, and necessity often, of draining through the cut cystic duct in certain acute cases, after cholecystectomy, and said that, instead of suturing it, he had clamped and cut it, and drained to the site with a rubber-tube drain submerged by a moderate gauze packing, and allowed it to heal by granulation.

Dr. E. Libman (by invitation) said that the usual impression was that bacteriæmia was very common in cases of gall-bladder disease and appendicitis. In his experience it did not occur very frequently. In appendicitis it must be very common. These observations were confirmed, he believed, by the fact that metastatic

dépôts in the joints, in the subcutaneous tissues, or in the viscera apart from the liver and lungs almost never occurred in such cases. It seemed that in some of the cases of disease of the appendix or liver the progress of the infectious process was stopped in the liver or in the lungs. And in some of these cases, while there might be bacteria in the blood current between the focus and the lungs, none were found in the peripheral circulation. Of course, in fatal cases, general ante-mortem invasion might occur.

To the cases in which bacteria were not found in the peripheral veins and the lungs were found to contain metastatic foci, Dr. Libman said he applied the term "non-systemic or partial bacteriæmia."

Dr. Lilienthal, in closing, emphasized his belief that any gall-bladder that was bad enough to be operated on ought to be removed. Even in a case of uncomplicated cholelithiasis, with multiple stones, in which operative interference was demanded, a cholecystectomy was preferable to a cholecystostomy, and less dangerous and difficult than the latter operation. He saw no reason why such a gall-bladder should be allowed to remain and make trouble later on. If the gall-bladder was thickened and there were gross macroscopical changes, it certainly should be removed, because it was prone to become the seat of malignant degeneration.

In dealing with cases of cholelithiasis, one could never tell how long the stones had been in the gall-bladder, nor could the condition of the interior of the organ be determined by mere inspection of its exterior. Such a gall-bladder might possibly be gangrenous all the way through to the serosa, and this fact would never be disclosed by any operation short of cholecystectomy. That the mortality of the operation was low was shown by the fact that he had only had one death in forty-two cases, many of whom were in a very desperate condition at the time of operating, with high temperature, sepsis, etc.

Dr. Lilienthal said that all of his forty-two cases were not operated on through the rectus incision; only the last twenty-five or thirty were done by that method, which he regarded as very satisfactory. The incision could be made as long as was necessary, although he had usually found four inches long enough.

Dr. Lilienthal said that Dr. Kammerer's second case, in which a number of stones in the common duct were overlooked, was an extremely interesting one. In order to prevent the possibility of leaving stones behind, the speaker said he first put in a retraction

suture through the cystic duct underneath the clamp, and then, after dividing the duct, he tied off the cystic artery, which could be done very easily. With that danger of hæmorrhage out of the way, the operator could make a thorough search, and if there was any trouble afterwards, it was due either to the presence of adhesions, or to a re-formation of stones, or to something that could not have been avoided. It was certainly not due to the cholecystectomy. Although cholecystectomy was the most radical operation that could be done on the gall-bladder, he did not consider it any more dangerous than appendicectomy nor cholecystotomy. If the case was a simple one, neither operation was dangerous; while if it was a serious case, cholecystectomy was less dangerous than cholecystotomy.

In answer to the question whether he would leave the cystic duct untied in acute cases, Dr. Lilienthal said he thought that precaution would be unnecessary if the duct looked normal, without showing any evidence of gangrene, and if there was no cholangeitis. If the latter condition was present, he would leave the duct untied. If the common duct was perfectly free, it furnished a natural and proper method of drainage into the bowel. If a good-sized probe could be passed through the cystic duct, there would be no necessity for slitting the common duct.

Dr. Charles L. Gibson related the history of a woman who was first operated on by another surgeon for empyema of the gall-bladder in 1901. She came under Dr. Gibson's care early in 1903, and was operated on by him on January 16 of that year. She then had a discharging sinus as the result of the previous operation. Upon excising the sinus and exposing the gall-bladder, the latter was removed and found to contain a gall-stone of considerable size and a small strip of iodoform gauze. The gauze was not in the gall-stone, but wrapped around it. The gall-stone in this case, Dr. Gibson said, had formed inside of two years.

INTESTINAL OBSTRUCTION FROM ADHESIONS DUE TO EMPYEMA OF GALL-BLADDER; SPONTANEOUS DISCHARGE OF THE SLOUGHING GALL-BLADDER.

Dr. Gibson presented a specimen taken from a woman of fifty-nine, who entered the hospital in September, 1903, complaining of symptoms of intestinal obstruction which had been present for four days. Some features of the case excited the suspicion of gall-stones. On opening the abdomen, the obstruction

was found to be due to an inflammatory mass composed of omentum and infiltrated intestine occupying the region of the descending colon. Upon inspection of the gall-bladder, it was found to be filled with pus and a number of large stones. These were removed and the gall-bladder drained. An artificial anus was made in the cæcum, and in the course of a few days the inflammatory condition in the region of the descending colon subsided, and ten days later the patient began to have some movement by the bowels. Her convalescence was interrupted by the onset of some acute illness, and it was four months before the artificial anus finally closed. Two weeks after the original operation, a sloughy mass presented in the wound, which was identified as the necrotic gall-bladder.

CHOLECYSTOTOMY.

Dr. Otto G. T. Kiliani presented specimens of gall-stones removed from a woman twenty-four years old, whose family and previous history presented no interesting features. Five months ago she began to complain of pain in the epigastrium, with vomiting, diarrhœa, jaundice, and chilly sensations. The jaundice persisted three days. These attacks recurred each month with increasing severity, the last one occurring two weeks ago. The stools during these attacks were lighter in color than usual.

Operation, February 24, 1904. A four-inch incision through the right rectus muscle revealed a normal looking gall-bladder. This was opened, and several stones of the mulberry type were removed. The gall-bladder was immediately closed with two layers of silk sutures. The abdominal wound was also closed, with the exception of a small gauze drain leading to the gall-bladder.

CHOLECYSTECTOMY.

Dr. Kiliani presented specimens removed from a woman who, upon her admission to the German Hospital on March 2, 1904, was so sick that no history was obtainable. She was operated on the following day by Dr. Kiliani. The gall-bladder was found much thickened and enlarged, and about to perforate at its base. It was incised and two large and several small stones removed. Cholecystectomy was then done and the cystic duct closed with chromicized gut. The wound was drained to the stump of the cystic duct and the surface of the liver, where the gall-bladder had been adherent. The outer wound was closed, excepting for drainage.

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting, March 7, 1904.

The President, HENRY R. WHARTON, M.D., in the Chair.

THE ADVANTAGES OF ABDOMINAL OVER VAGINAL HYSTERECTOMY IN CARCINOMA.

DR. JOHN B. DEAVER said that he saw a large number of cases of uterine carcinoma each year, many of which have passed beyond the stage for operation. Unfortunately, many of the subjects of this disease suffer from symptoms not at all well defined, are free from pain, and have but little discharge until the growth has become so extensive as to forbid radical interference; for this reason the family doctor is often unaware of the real nature of the disease until it is too late to resort to surgical interference.

Irregular bleedings from the uterus, whether before, during, or after the menopause, should excite the apprehension of the general practitioner, as well as the surgeon, to investigate, at any rate. It is absurd to consider feelings of delicacy and allow them to prevent an inspection of the cervix and palpation of the body of the uterus, nor in doubtful cases fear of consequences deter resort to curettage with examination of the scrapings. Negative findings by the pathologist should be accepted with great reserve and not be allowed to controvert unmistakable clinical symptoms, especially in women approaching or past the menopause. He emphasized the latter, because, as is well known, epithelioma rarely begins until after the child-bearing period.

The differentiation between hæmorrhagic endometritis and commencing maligant disease is not always possible; in fact, it

is the practice of the writer, in those cases of hæmorrhagic endometritis occurring about the change of life with a large and flabby uterus and family history of malignancy, to make a complete removal of the uterus.

In hæmorrhagic or hypertrophic endometritis with foul-smelling discharge, the uterus should be curetted and the findings examined microscopically. A negative finding does not necessarily prove the absence of carcinoma, as the curette may have escaped the cancer area, or the carcinoma be within the uterine muscle. Excision of a small portion of the uterine tissue for microscopical examination can only be considered where the disease is of the cervix.

The class of cases of carcinoma of the uterus which perplex the surgeon most in determining what is best to do are those which are not seen early; when it is questionable whether the tissues outside the uterus are involved, rendering it difficult to determine even the propriety of radical interference. The most common site of carcinoma of the uterus is the cervix, which is usually squamous-celled, and early in the disease is essentially a local process, hard and indurated, with papillæ elevated from the surface of the mucous membrane. These papillæ increase and enlarge, giving rise to the cauliflower-like growth so often seen; ulceration and necrosis soon follow, implicating the vaginal vault, the broad ligaments, the bladder, and rectum. When the case has assumed this stage radical treatment is, as a matter of course, not to be considered. One of the important questions to be decided in the operation for radical cure of carcinoma, be it situated in the uterus or elsewhere, is, Can the excision of the cancer area be performed by section through normal tissue?

For the relief of the discharge, the bleeding, or the pain in advanced carcinoma of the uterus, local measures, as the curette and cautery, are more efficacious than the use of the knife. The most careful bimanual examination must be made to determine the advisability of radical operation, also must the patient's general condition and the absence of other organic lesion be favorable. The radical operation is, in the speaker's judgment, only to be considered in the early stages of the disease. He had found that the pain consequent upon the recurrence of carcinoma following late and extensive operation is greater than in cases of the kind which have been curetted and cauterized.

The speaker practises and strongly advocates total ablation of the uterus by the abdominal route in early carcinoma of the cervix. He felt sure this operation promised more, both immediately and ultimately, than does the removal by the vaginal route. In the early stages complete removal of the uterus, broad ligaments, and the lymph channels in the latter, with possibly the iliac lymph glands in some cases, should guard against recurrence with reasonable security.

It is interesting to note that Professor Jacobs, of Brussels, one of the earliest advocates of vaginal hysterectomy for cancer of the uterus, has entirely changed his views, and now only does the vaginal operation when the abdominal route is impracticable. Jacobs states that he never has had a case of uterine cancer operated upon by the vaginal route to live more than three years, and that the majority of them were dead at the end of one year. In contrast to this he has a number of cases, upon which he operated by the abdominal route, that are living and well after four years. Jacobs practises the removal of the pelvic glands.

Professor von Rosthorn, of Heidelberg, also practises cleaning out of the glands of the pelvis in carcinoma of the uterus; in fact, this is the common practice at the present time on the Continent. It would seem as reasonable to remove the glands of the pelvis in connection with removal of the uterus in early carcinoma as it does to remove the glands of the armpit in early operation for the removal of cancer of the mammary gland. It scarcely seems necessary to say that this is a useless procedure where there is already systemic involvement. The Halsted operation for carcinoma of the mammary gland, as practised by Dr. Deaver, is only done in the early cases. It is useless to make so extensive a dissection after there is advanced involvement of the axillary, subclavian, and supraclavicular glands. When the latter condition is present, it is evident that the disease has advanced beyond the reach of the surgeon's knife, particularly in the shape of involvement of the intrathoracic glands.

He strongly opposed vaginal hysterectomy in carcinoma of the cervix, except in the presence of obstacles necessitating such a course, for instance, a very stout abdomen, nephritis, etc. Early carcinoma of the fundus of the uterus is the condition in which he practised vaginal hysterectomy, and not in the cases where sufficient time has elapsed to have allowed the lymphatics of the cervix uteri to have become involved.

The vaginal operation in carcinoma of the cervix offers no advantages over abdominal section when the latter is properly performed, and suffers from the charge of being an incomplete procedure, dangerous to the ureters, and liable at any time to be followed by secondary bleeding. The abdominal operation certainly gives the only chance for the proper cleaning of the pelvis, offers greater security against hæmorrhage and less risk of injuring the ureters; the field of operation is kept constantly in view, the patient in the Trendelenburg position, and the intestines kept out of the way of injury and infection by the proper placing of gauze pads. That we can cut farther away from the diseased area in the abdominal than in the vaginal operation, we must admit.

In the abdominal operation, he never had any fear of injuring the ureters if the bladder with the anterior serous flap was carried well forward and upward behind the pubic bone. If the operator is not content with this, it is a simple matter to expose the ureters. The introduction of ureteral catheters or bougies to safeguard the ureters had not been his practice. He had always feared more the consequences of carrying an instrument from the bladder into the ureters and exposing the kidneys and ureters to the danger of infection than injury to the ducts.

He was an advocate of dissection of the lymphatic glands of the pelvis in all cases of carcinoma. He did believe, however, that in certain selected cases this operation is not only feasible, but in order. In this connection he furthermore said that the dissection of the pelvis should be done as readily, the conditions requiring it, as a deep dissection of the neck; the same amount of care in exposing the lesion and the structures in relation therewith, thus avoiding unnecessary mutilation, should be carried out in the same anatomical manner as in the dissection for the removal of an enlarged thyroid gland. This being done, fewer ureters will be injured, fewer cases of secondary hæmorrhage, of postoperative vesical fistula, intestinal fistula, etc., will have to be noted. The individual ligation of vessels of any size as opposed to the mass ligature or the use of that abominable instrument, the angeiotribe, be it the plain or electrical hæmostatic instrument, he strongly urged.

In connection with the discussion of the propriety of the removal of the pelvic lymph glands, it is interesting to note that

the lymphatic system of the uterus is composed of a rich network of vessels, those from the vagina and lower portion of the cervix following the uterine vessels to glands at the bifurcation of the common iliac arteries, usually three in number, whence they pass upward. The lymphatics of the body of the uterus anastomose with those of the cervix uteri, travel downward to the deep inguinal glands by way of the round ligaments, and pass through the utero-ovarian ligament, emptying into the lumbar glands. Notwithstanding these abundant lymphatics, carcinoma of the uterus spreads more rapidly by continuity of tissue than through lymphatic metastasis; therefore, the argument in favor of removal of the pelvic glands is weakened. Certainly the only cases that promise anything are those where the glands have not yet become involved. Experience teaches that extension of the cancer downward into the vagina and backward into the rectum is much more common than metastasis into the pelvic glands.

Epithelioma of the vagina has been overlooked as a point of metastasis or implantation, the diseased area resembling so much an excoriation and has been mistaken for such, believed to have occurred in preparation for operation. Early involvement of the bladder may be recognized only by means of a cystoscopic examination.

The technique of the abdominal operation is comparatively simple. The abdomen opened through the right rectus muscle, the contents of the pelvic cavity palpated to determine the presence of adhesions, and if the disease has extended beyond the uterus, the patient is placed in the Trendelenburg position, the intestines and great omentum are protected by gauze pads carefully placed. With the gauze pads properly placed the field of operation in the pelvic cavity is well exposed. Traction is now made upon the fundus of the uterus, drawing it upward and backward, when an incision is carried from the pelvic end of one round ligament to that of the other, and through the serous covering of the anterior surface of the uterus at the point of reflexion of the peritoneum from the uterus on to the bladder. This serous flap is displaced downward, carrying the bladder with it; the dissection is carried as far down as possible, in this wise displacing the bladder upward behind the pelvic bone, thus exposing the anterior wall of the vagina and carrying the ureters out of harm's way. The next step in the operation is tying off the ovarian arteries to the outer or

inner side of the ovary or ovaries, depending upon the advisability of removing or leaving them. It is his practice to leave the ovaries in cases of carcinoma occurring in early life. The uterine arteries and veins are next exposed as they pass from the side of the pelvis to the cervix uteri and tied between two ligatures and divided; in making the dissection to expose these vessels the ureters are exposed, and thus rendered less liable to injury. The next step in the operation is cutting the cervix out of the vagina with the removal of the organ. The vaginal walls are now whipped over with a continuous catgut suture, a piece of iodoform gauze placed in the vagina allowing a small portion of it to protrude into the pelvis, when the anterior serous flap is brought over the protruding gauze and stitched to the posterior surface of the vaginal wall or the serous covering of the sigmoid flexure, as the case may be. The gauze pads removed; the intestines and great omentum placed in normal position; the abdominal walls closed with tier suture; the abdominal wound dressed and an aseptic dressing applied to the vulva, and the patient returned to bed. The head of the bed is elevated, unless there are symptoms of temporary shock, when this is not done until the patient has recovered from shock.

In making a vaginal hysterectomy, he preferred to use clamps rather than ligatures.

Dr. William J. Taylor said he agreed in every particular with the statements made by Dr. Deaver. He had performed his last vaginal hysterectomy. In the last patient upon whom he did this operation, for a malignant growth of the uterus, it was followed by infection, with a resulting peritonitis. The peritonitis was followed by embolism and dry gangrene in the right forearm that necessitated amputation above the elbow. The patient left the hospital minus not only her uterus but also her right forearm; this result occurring in spite of the fact that all possible care was used in the operation. It decided Dr. Taylor against further use of the vaginal method.

Dr. Deaver said that Dr. Taylor was fortunate in that his patient did not lose her life. His brother had an experience with a similar condition, but his patient died. She was a large, stout woman, and during the operation her limbs were held by assistants. They did what residents are prone to do,—use the limbs as a hammock and go to sleep,—and as a result of the excessive flexion during a long operation thrombosis, gangrene, and death occurred. The case demonstrated that assistants should be awake.

LOOSE BODY REMOVED FROM THE KNEE-JOINT.

Dr. Henry R. Wharton reported the case of a man, aged fifty years, who was admitted to the Presbyterian Hospital January 19, 1903, with the following history: Early in November he wrenched his right knee, but, although the knee gave him some pain, he was able to continue his work. Shortly after the accident he began to suffer with occasional pain and disability in the right knee, and experienced a sensation as if something had slipped out of the joint upon certain motions of the joint. In December the symptoms became aggravated, so that at times when walking the body slipped out of the joint, produced intense pain, and caused the knee to give away under him, so that he would fall. He became so uncertain in his movements that he was compelled to give up his work. There would often be intervals of several days when he suffered from no displacement of the body.

After his admission to the hospital, upon certain movements of the joint he was able to bring the body out of the joint, so that it could be located, when the joint was flexed, near the inner edge of the patella.

After the body had been located, it was fixed by a needle passed into it through the skin, and a firm compress was also applied above it to prevent its slipping back into the joint. The patient was then anæsthetized and an incision made through the skin over the body, and it was removed. It proved to be a bony body, convex upon one surface, partially covered with cartilage, and about the size of a Lima bean. The wound was closed by two layers of sutures, and the joint fixed by a plaster-of-Paris bandage. The superficial sutures were removed upon the tenth day, and the wound was found healed.

The etiology of loose or movable bodies in the knee-joint is not definitely settled. Their presence is attributed by various authorities to detached synovial fringes, which remain free in the joint; or to detached osteophytes; or to the detachment of portions of bone or cartilage from a wrench or twist of the joint; or the detachment of a portion of the articular surface of the bone or cartilage by a quiet necrosis without suppuration. Fibrous bodies are said to frequently result from the organization of blood-clots following injury of the joint. The body may be entirely loose, or attached by a long or short pedicle. The bodies vary in size from a pea to a body an inch or more in diameter, and may be carti-

laginous, fibrous, or bony in structure. The symptoms vary in intensity, and may disappear at intervals, and appear to be due to quiescence or mobility of the body. Fixation of the joint occurs at intervals, as the body occupies certain positions in the joint. Nausea when the body becomes displaced is not an uncommon symptom in many cases. The presence of the body sooner or later causes disability and weakness of the joint from chronic synovitis, with stretching of the ligaments.

The most satisfactory treatment of this affection is the removal of the body by incision. It is wise, however, not to attempt to remove the body unless it can be definitely located, as it may be difficult to find even after an extensive exposure of the knee-joint. The operation, with careful aseptic details, is accompanied by little risk.

Dr. John B. Roberts said that he once undertook to remove what was thought to be a movable body from the knee-joint and was surprised to find that it was an osteoma or osteophyte on the femur. The fascia slipping over this gave the sensation of a movable body. The treatment for both conditions being the same,—removal,—the mistake in diagnosis was not of importance.

Dr. James K. Young mentioned two cases that he recently had seen. One, under the care of Dr. Willard, was in an athlete from whose knee the loose body was taken out in two pieces, the tissue being cartilage. The second case, under his own care, is in a woman of fifty years. In this instance the movable body, which is larger than those usually found, is situated above and internal to the patella. The patient has not as yet been operated upon.

Dr. W. Barton Hopkins said that he had seen in the laboratory of the Pennsylvania Hospital several loose bodies that recently had been taken from the knee-joints of an aged colored man who died in the medical ward of that institution. The largest concretion measured 6½ by 4½ by 2½ centimetres and weighed fifty-five grammes. The two smaller concretions in the right knee-joint were not measured or weighed. It was mainly fibrocartilage, but had a small bony nucleus.

Dr. George G. Ross mentioned a case which illustrated a point made by Dr. Wharton regarding the difficulty of securing a loose body that has not been accurately located or anchored before opening the joint. In this instance the body could not be found until the finger was introduced and the joint explored. Fortunately, infection did not follow this manipulation.

FRACTURE OF SPINE, ACCOMPANIED BY AN ENORMOUS PROSTATIC CALCULUS WITH PYONEPHROSIS, AND FINALLY A GUNSHOT FRACTURE OF THE SKULL.

Dr. W. Barton Hopkins presented the following outline of the history of this case:

M. S., aged twenty-eight years (?), born in Germany; was admitted to the late Dr. J. M. Da Costa's ward in Pennsylvania Hospital, January 6, 1899, with pneumonia. The evening of his admission he became wildly delirious, requiring restraint in bed. Later on he succeeded in slipping his straps, jumped out of the window, and fell upon the grass, a distance of fifteen feet.

On being brought back into the hospital he was found to have sustained a fracture of the lower dorsal or upper lumbar vertebra, accompanied by complete paralysis from the waist down. The shock of the injury in conjunction with his serious illness rendered his condition desperate. Note of the physical signs of his chest showed pneumonia of the right lung. His breathing was rapid and shallow and he was much shocked. He slowly reacted, and at the end of a week his general condition having improved, Buck's extension apparatus was applied to both legs and counter-extension to the head; but a fortnight later, there being no benefit from the latter, it was removed.

In six months his general condition had very much improved, but the paralysis remained unchanged.

Having had occasional attacks of hæmaturia, the presence of vesical calculus was detected about this time. From then on the urine contained blood and pus, varying in quantity but always present. About this time (1901) the patient was able to sit up in a wheel-chair, thus relieving the pressure over the bed-sores which were present. His flesh was good and he was strong and able in his upper extremities. A pair of adjustable crutches was applied to the chair so that he could elevate and lower them, and thus take more or less weight off of his buttocks. In this way not only were the bed-sores made to heal, but his ability was much increased to wheel himself out of doors, and thus obtain exercise and fresh air.

His mental state was generally quiet and contented. The stone which was thought to be vesical, but proved post-mortem to be prostatic, had increased enormously in size, and the urine contained large quantities of pus, but he obstinately declined to be relieved by operation.

January 26, 1904, his stomach gave out, and this apparently being the last straw, he became hopelessly despondent, and four days later, obtaining a pistol, shot himself in the right temple and died in about ten minutes.

An autopsy was made January 30, 1904, by Dr. Longcope, who has furnished the following notes:

The body is that of a young man 163 centimetres in length. Rigor mortis absent. Body still warm. There is very slight post-mortem discoloration over back and shoulders. Pupils equal and dilated. The upper extremities, neck, and thorax show a moderate grade of muscular development. Below the umbilicus there is extreme emaciation of all the muscles. The pelvis and lower extremities are almost literally skin and bones. The abdomen is scaphoid, and the anterior superior spines of ilium stand up prominently. The circumference of the middle portion of right thigh is seventeen centimetres; on the left side it is seventeen and one-half centimetres; about the middle portion of right tibia, fifteen and one-half, and left, fifteen centimetres. The feet are in talipes equinovarus position. There is no œdema of lower extremities. Penis is small. There is a narrow band covered with skin which goes from prepuce to glans on dorsal aspect of penis. Over the tuber ischii there are purple splotches, and over the sacrum the skin in places shows shallow ulcerations.

In the right temporal region, six centimetres above the zygoma and in a line with the middle of this bone, the hair for an area of two and one-half centimetres across is matted with blood. Around the margin the hair is singed. The tip of the ear is blackened, and there are black marks at the outside of the supraorbital ridge. In the centre of the area where the hair is clotted with blood a small, ragged, round hole one-half a centimetre in diameter is found in the scalp.

Muscles are pale.

Abdominal Cavity. The omentum is pale, delicate, and has very little fat, but covers the intestinal surfaces well. Peritoneal surfaces are smooth and glistening. Appendix measures twelve centimetres in length, lies behind the cæcum, and is patent throughout.

Thorax. Lungs collapse upon removal of sternum. On left side the lung is bound down to thoracic wall by old fibrous cobweb adhesions. On the right side the pleural cavity is free from fluid

and adhesions. Pericardial cavity contains a small amount of clear, straw-colored fluid; serous surfaces are everywhere smooth and glistening.

Heart. Weight, 200 grammes. The heart is of medium size; epicardium everywhere smooth and glistening and contains some fat. The right side is distended with firm red and white post-mortem clots. All the valves are thin, delicate, and normal. The endocardium is slightly thickened over left ventricle. The heart muscle is firm and brownish gray in color. Left ventricular wall averages from ten to fifteen millimetres in thickness. The aorta shows some slight sclerosis. Walls of coronary arteries are thickened, but the arteries are patulous.

Lungs. The left lung is rather small, soft, and crepitant throughout. The surface is dark purplish blue mottled with black. On section, the cut surface is everywhere pale pink, soft, and crepitant. Bronchi at the root contain a small amount of mucus. Vessels are clear. The posterior part of pleura is covered with old fibrous adhesions.

The right lung is exactly like the left, the pleura being everywhere smooth and glistening.

Spleen. Weight, 190 grammes. Size, 13 by 8 by 5 centimetres. The capsule is delicate, smooth, and free from adhesions. The color is dark purplish brown. Consistency not decreased. On section, the cut surface is smooth, somewhat mottled brown, and red. Malpighian bodies are of medium size. Trabeculæ are not increased.

Liver. Weight, 1220 grammes. Size, 21 by 17 by 9 centimetres. The liver is rather small, not increased in consistency, regular, smooth, and dark purplish brown in color. The capsule is free from adhesions. On section, the cut surface is smooth and brownish in color. Lobules are fairly well marked, their centres are small and reddish. Portal connective tissue not increased. Bile ducts patent. Gall-bladder apparently normal.

Urinary bladder, ureters, and kidneys removed together. While the bladder is being removed, a large concretion escapes from the prostatic portion of urethra which has been cut through. On opening the urethra and bladder the solid portion of prostate has entirely disappeared; instead of a gland there is a large, thin-walled sac which contained the concretion, and apparently surrounded it completely.

The stone is rather soft and crumbling.

It is quite regular in shape and looks as if moulded into the form of a large prostate. It is divided into three or four more or less well-defined lobes and presents a general heart shape, the apex pointing towards the neck of the bladder. On the under surface there is a rounded depression about one centimetre in diameter, into which fits the verumontanum. At the base the stone measures six centimetres in diameter, at apex, three centimetres. It is six centimetres in length and four and one-half centimetres in thickness at the base. At the anterior portion of base there is a rounded mass about two centimetres in diameter. This ends in a round process with a broken end. This process is apparently a cast of the membranous urethra. A second tip-like process extends from the superior lobule into the neck of the bladder. The wall of the sac containing the concretion is gray in color, and is covered with much pus and some mucus. The verumontanum is about the size of a cherry-stone. The ducts leading into the seminal vesicles are patent. Neck of bladder rather small. On opening the bladder the cavity is small, and is entirely filled with a thick, stringy, yellow pus having a rather foul odor. A few masses of calcareous material are also found.

The wall of the bladder is much thickened and the organ is very small; wall measures in places one and one-half centimetres in thickness. The mucous membrane is corrugated, thickened, and red in color. There are some adhesions about the seminal vesicle. Both ureters are distended to the size of one's thumb, and on pressure the ureteral orifices, which are difficult to find, are marked by a spurt of yellowish pus. The intravesicular portion of both ureters is very small and shows some actual constriction, for it is difficult to get even a small probe through the orifice. When the ureters are opened the stricture in the bladder wall is very noticeable, above this the ureters are dilated into tubes about two and one-half centimetres in circumference. The wall is thickened and the mucous membrane is very much reddened. Both ureters contain thick yellow pus. The dilatation continues up to and into the pelves of the kidneys.

The left kidney measures 13½ by 7 by 5½ centimetres. The kidney is very large and very soft, having almost a fluctuating feel. It is somewhat irregular in shape. The capsule strips readily,

leaving a fairly smooth but lobulated surface, which is mottled purple red and gray.

It is dotted with irregular opaque yellow points and areas which measure from one to ten millimetres in diameter. The largest ones are quite soft. On section, the pelvis and many of the calyces are enormously dilated, and all are filled with stringy yellow pus. At times the dilated spaces reach within one and one-half centimetres of the surface, in which event the kidney substance appears as a gray or red line destitute of normal markings and dotted with yellow points. In other places the cortex and medulla vary from one to three centimetres in thickness. In these portions the medullary pyramids are swollen, reddish, and ill defined from the cortex. The cortex is very irregular; it measures from five to ten millimetres in thickness. Sometimes the triæ are fairly well marked and the glomeruli stand out as red points. In these areas the cortex has a general red look. In other places the markings of the cortex are lost, and the kidney shows extreme red and yellow mottling, while opaque, yellow streaks extend from the medullary pyramids into the cortex. The wall of the pelvis and calyces are much thickened, reddened, and in places covered with soft yellow material.

The right kidney measures 13 by 12 by 5½ centimetres. It is much softer than tne left, has a more nodular appearance, and feels much like a thick-walled cyst. The surface is paler, and shows many more of the soft yellow areas. On section the pelvis and calyces are so much dilated that very little of the kidney substance remains, and almost none that retains its normal markings.

Many of the calyces end in abscesses, the wall of which reaches within two or three millimetres of the surface and is covered with thick, tenacious, yellow pus. Adrenals are apparently normal. Pancreas, stomach, and œsophagus apparently normal. Intestines are apparently normal.

Aorta fairly smooth.

Testes are apparently normal but rather soft.

The spine from the sacrum to the fourth cervical vertebra is removed *en masse*. At the level of the twelfth dorsal or first lumbar vertebra there is a slight deformity. The body of the last dorsal vertebra is small and compressed, and the spine curves somewhat forward and to the left side. Over the lamina there are bony exostoses which fill almost entirely the space between the

spinous processes and lateral processes. On sawing through the laminæ and exposing the cord it is seen to be rather small, except just beneath the deformity, where there is a hard, irregular swelling about the size of one's thumb-nail. Here the dura mater is adherent to the bony canal.

Brain. The skull immediately beneath the wound in the scalp shows a ragged round opening two centimetres in diameter. On the inner surface of the temporal bone the inner table is somewhat torn. There is extensive hæmorrhage beneath the dura mater and also beneath the pia mater in places. Corresponding to the hole in the scalp and dura beneath it there is a large tear in the substance of the brain which involves the fissure of Sylvius about four centimetres anterior to the foot of the fissure of Rolando. About it there is an extensive hæmorrhage beneath the pia mater. In the superficial portion of the laceration, a piece of bone two centimetres in length, one centimetre in width, and one-half centimetre in thickness together with a small mass of lead is found. On the median surface of cerebrum a second laceration is found midway between the fornix and the surface of cortex and five centimetres back of anterior point of fornix. The falx cerebri is perforated by an opening one centimetre in diameter, the perforation corresponding exactly with the situation of the laceration in cerebrum. The left hemisphere shows two lacerations, one on the inner surface and the other on the cortex; they are only two and one-half centimetres apart. Embedded in the brain substance on left side just below the pia mater there is a small piece of lead; it lies in the foot of the postcentral lobe one and one-half centimetres above the fissure of Sylvius.

Anatomical Diagnosis. Double pyelonephrosis; chronic cystitis; calculus of prostatic urethra; old fracture of last dorsal and first lumbar vertebræ; laceration of brain by a leaden bullet.

Dr. John B. Roberts described briefly a similar case upon which he recently had operated. The patient had attempted suicide and was unconscious when seen. Marked exophthalmos was present; it being readily surmised that the bullet had passed just behind the orbits and that the cavities were probably filled with blood. The skull was trephined at the point of entrance of the bullet and fragments of bone and a great deal of blood were removed. On the opposite side of the head was an increasing swelling of the scalp, which, when opened, showed that the bone was

broken but not perforated by the bullet which had passed through the brain. The bullet had caromed and was found in the brain one and one-half inches posterior and below the wound in the skull. The patient had lost a great deal of blood and soon afterwards died.

PULMONARY COMPLICATIONS FOLLOWING ABDOMINAL OPERATIONS.

Dr. R. P. McReynolds said that in looking over a series of 100 cœliotomies in order to determine the frequency of postoperative pulmonary complications, he had found two cases of bronchopneumonia, one of bronchitis, one of abscess of lungs, and three of pleurisy. The case of bronchitis followed an operation for mistaken perforation of a typhoid fever ulcer, and may possibly have been due more to the fever than to the operation. It was of short duration, and the patient made an uneventful recovery from the bronchitis, the typhoid fever, and the operation. The cases of pleurisy have been of the simple plastic variety, and were easily cured by strapping the affected side with adhesive plaster. He gave brief histories of the other cases:

Case I. (*Bronchopneumonia following Hysterectomy for Uterine Fibroid.*)—Operation, August 12, 1902; ether anæsthesia. Mrs. P., aged thirty-five years, sought relief from pain and hæmorrhage caused by a small uterine fibroid. He hesitated to do a radical operation upon her because of a tubercular family history and an undoubted latent tubercular foci in her own lungs. An attempt was made to relieve her by dilating and curetting the uterus, but this was a complete failure, and one year later he was forced to do a hysterectomy. The day following the operation she began to cough and temperature suddenly went up to $101^{2}/_{5}°$ F.; during the next three days there gradually developed a typical bronchopneumonia of left lung. Frequent examinations of the sputum failed to demonstrate the presence of tubercular bacilli. She made a slow recovery, and left the hospital still suffering from a slight hacking cough. Sixteen months after the operation she died from pulmonary tuberculosis. There were no abdominal complications throughout. The ether and the Trendelenburg position were probably the cause of the pneumonia.

Case II. (*Bronchopneumonia following Double Salpingo-*

oöphorectomy for Bilateral Tubo-ovarian Abscess.)—Operation, November 28, 1903; ether anæsthesia. Glass drainage.

The temperature began to go up immediately after the operation, and the following day it was 103° F., and there were present the physical signs of bronchopneumonia of right lung. The coughing caused the through-and-through abdominal stitches to cut out, which retarded her convalescence somewhat. She, however, made a good recovery and is perfectly well to-day. The patient had developed a slight cough (which had been overlooked) the day before the operation. The pneumonia resulted probably from the inspiration of some foreign substance into the lungs at a time when their resisting forces were impaired.

Case III. (*Opening and Draining Abdominal Abscess caused by Perforation of Typhoid Fever Ulcer.*)—Operation, March 23, 1902; Chloroform anæsthesia. The convalescence in this case was normal up to the second week, when he developed a slight cough, and a little later there were present physical signs of consolidation of right base. Frequent punctures with aspiration-needle into the pleural cavity and the lung substance itself failed to locate the pus, which finally ruptured into a bronchial tube and was coughed and spit up. He made a tedious but perfect recovery and is strong and well to-day. No abdominal complications throughout, wound granulated and healed normally.

The numerous lymphatics running along the psoas muscle enable the infection to travel upward towards the diaphragm; it is then conveyed to the lungs through the blood current and there forms a foci of infection, around which an abscess gradually develops (metastatic pneumonia).

In these cases were illustrated the most frequent causes of postoperative pneumonia, *i.e.*, the irritating effect of ether itself; tne inspiration of foreign substances during etherization; septic emboli.

Other causes are, exposure and wetting during an operation; prolonged use of Trendelenburg position and the forced retention of the intestines upon the diaphragm; intravenous injection of normal salt solution.

To prevent chilling during the operation the electric pad laid over the operating table has been recommended. It is theoretically all right, but practically it is worse than useless, and he mentioned it in order to condemn its use. In prolonged abdominal operations

upon patients who are very weak and debilitated, pulmonary complications can to a certain extent be prevented by having the extremities and the chest covered with cotton during the operation.

The best way to prevent the patient from becoming wet is to use as little water as possible during the operation.

Dr. Körte, of Berlin, has a technique which he had copied and found most satisfactory. The hands after being sterilized are wiped dry, and this is repeated after each washing during the operation. The instruments after boiling in soda solution are dried and placed upon a sterile sheet spread over a glass top table. After using an instrument it is taken by a nurse, washed in hot soda solution, dried and placed back upon the table,—another nurse, wearing sterile dry gloves, threads the needles, hands the instruments, etc.

The indiscriminate use of intravenous injection of normal salt solution is capable of producing serious and even fatal cardiac and pulmonary complications. It is a very nice little operation itself and should not be intrusted to one who has not had some surgical experience. One must always bear in mind the possibility of causing an embolism from the introduction of air into the veins during the administration of the solution. When the lungs are congested from the irritating effects of the ether or from any cause whatever, and the right heart is already embarrassed, the sudden introduction into the circulation of a large quantity of fluid may cause complete cardiac failure, or further embarrass the heart, and so aggravate the existing congestion of the lungs. This is especially apt to occur when the patient is in the Trendelenburg position and the intestines are pushed and held up against the diaphragm, thereby preventing the normal downward expansion of the lungs.

A large number of patients requiring abdominal operations have been ill for years, and during this time their bodies have become more or less worn and emaciated. The heart and lungs have adapted themselves to the change and are no longer capable of responding to a sudden call for extra work. If in these cases there is the one indication for intravenous injection of salt solution during an abdominal operation, *i.e.*, loss of blood, it should be given slowly, and the temperature of the solution not allowed to drop from 110° F. during the administration.

Dr. John B. Roberts said that patients get pulmonary complications after operation as a result of oversight in their care. In

some instances it is a question of too much ether and too little undershirt. It is the common failing of hospital residents to give too little ether at first, when a great deal is needed, and too much afterwards. When patients are overloaded with ether, particularly if in the Trendelenburg position, it is little wonder that they contract pulmonary congestion, pleurisy, and pneumonia. It is the practice in many hospitals to take off the underclothing of new patients and give them only a night-shirt of thin muslin that is open in the back. The patient is then operated upon, given too much ether during the operation, and afterwards taken to a ward where the beds are placed with the head towards and under the window. Such practice is responsible for some cases of pulmonary complication. Too little thought is given to the care of the patient before and after operation. It is customary to combat these shock-producing agencies by infusing saline solution. The practice of putting salt solution into a vein at the bend of the elbow is becoming entirely too much of a fashion among hospital residents.

Dr. Joseph Spellissy, apropos of the reference of Dr. McReynolds to the unsatisfactory results from the use of the electric pad during operations, said that one had been used at the University Hospital, in the service of Dr. Willard, during the past five years. The appliance has given a great deal of comfort and is efficient in keeping the patient warm. No burn of a case has occurred, and many patients have undoubtedly been much benefited by its employment.

Dr. Richard H. Harte referred to the scrupulous care exercised by the late Dr. Ashhurst in keeping his patients covered during and after operation as an effective means of preventing complications. Certain surgeons in the West are reported as having ceased to employ ether anæsthesia because of the frequency with which it is followed by pneumonia. That such results can be attributed to ether is not borne out by his own experience, as he does not lose cases from postoperative pneumonia. He is very careful to keep his patients covered, and this unquestionably has its effect in preventing complications. Hospital residents are often careless in such matters, and the routine of admission in many hospitals is to take off the patient's flannels, bathe him, and put on him a thin muslin shirt. This cannot help but cause a tendency to take cold. Patients will not get pneumonia if they are carefully looked after before, during, and after operation. The intravenous

injection of salt solution is a very good thing in many instances, but its use is at times abused.

Dr. John B. Deaver concurred with the statements of Drs. Roberts and Harte. Regarding the shirts worn by hospital patients, he fought out that question years ago, and now it is a standing rule in the German Hospital that every patient dons a flannel shirt, and wears it to the operating room if operated upon. Dr. Deaver has never used the electric mattress, but employs the hot-water bed for all cases of operation upon the upper abdomen, as gall-bladder and stomach cases. Burns from this appliance will not occur if reasonable care be used. In the classes of cases mentioned, the arms, chest, and lower extremities are before operation enveloped in cotton and bandaged. With all these precautions, pneumonia may develop. Often too much ether is given. He watches the anæsthetizer. He is often asked how he manages to do this, but it is part of a surgeon's duty. Everybody in the operating room should be watched. Dr. Deaver never allows the use of any anæsthetic but straight ether, opposing the use of nitrous oxide, and other combinations, to the extreme. There is one trouble with many trained nurses, and that is that they kill people with fresh air; opening windows in the operating or recovery room may easily cause a fatal complication. Saline infusion has its place, but only trained house physicians should be allowed to use it. Air will not enter the vein if proper precautions are observed. Infusions are seldom called for except in cases of hæmorrhage. As to the statement made regarding dry hands and instruments, dry surgery is preferable to wet surgery in every instance. Shock comes from prolonged operations. It is no wonder that patients die after hysterectomy lasting two hours or longer; when fifteen to thirty minutes should suffice, as a rule. The patient is necessarily overetherized in long operations. The hot-water bed is not used to prevent shock but to prevent complications in the thoracic cavity. We hear much about shock from loss of blood, but unnecessary manipulation of the abdominal contents is a more fruitful source. In answer to a question of Dr. Taylor as to whether his patients had backache after being on the hot-water bed, and if he attributed this to the heat or to the surface of the bed fitting the inequalities of the patient's body, Dr. Deaver said that nearly all his patients complained of backache after abdominal operations, but he had never thought of the bed as being the cause.

Dr. James K. Young endorsed what had been said in favor of the electric mattress. No shock has occurred among the children operated upon in the University Hospital since it has been used. Prior to its use, four children were severely shocked, apparently from cold during operations. Recently, while performing a double astragalectomy in another hospital, the lack of the mattress was forgotten for the time, and the patient became severely shocked, although the etherizer reported his condition good after one side had been completed. No burns by the mattress have occurred. Dr. Young believes that some of the burns reported from the use of the mattress are due to the combination of solutions used to wash the patient,—alcohol, green soap, etc. These run under the patient and then on the mattress, and burns result.

Dr. John H. Gibbon, in speaking of the effect of air entering the vein while saline solution is being given, related a personal experience met with at West Chester during the past year. The infusion was being given hurriedly after an operation for a perforated gastric ulcer. The salt solution was allowed to run through the nozzle before it was introduced into the vein, but afterwards, through the glass coupling in the tube, a considerable amount of air was seen to pass into the vein. Some untoward result was at once expected, but no bad effect upon the patient was noticed. Dr. Gibbon has heard of the same thing occurring in the experience of other surgeons, and, while he would not consider it advisable to relax every care to prevent the passage of air into the veins, he thinks the danger of this occurrence may have been exaggerated.

Dr. Henry R. Wharton said that he formerly used the electric mattress and found it of service in combating shock. One patient afterwards had an immense slough eight inches in diameter over the buttocks, however, and since that time he has been very careful in its employment.

INGUINAL HERNIA OF THE UTERUS.

Dr. John H. Jopson read a paper with this title, for which see page 98.

Dr. John B. Deaver put on record a case of strangulation of the fimbriated extremity of a Fallopian tube of the right side, which was thought to be a femoral hernia.

Dr. John H. Gibbon described briefly a case of left femoral hernia in a woman of seventy years, operated on by him at the

Pennsylvania Hospital. The patient had been operated on some years previous, the later condition being a recurrence. When the sac was opened, it was found to contain the cæcum, with the appendix, the ascending, transverse, and descending colon as far as the sigmoid and the entire omentum. He had previously reported two left cæcal hernias, this making the third. The patient made a good recovery, and had no return of the hernia when she left the hospital. Transposition of the viscera was not present in any of these cases. The two reported cases were left inguinal herniæ.

Dr. Henry R. Wharton mentioned the case of a woman who was thought to have incarcerated omentum in a right inguinal hernia. She was then four or five months pregnant. Operation revealed the contents of the sac to be a pedunculated fibroid of the uterus This was removed and the patient went to full term.

Dr. Jopson said that where a hernia of the Fallopian tube was present it was also possible to have hernia of the ovary. He had at first but little hope of curing this patient's hernia, but there were no signs of recurrence several weeks after the operation. There apparently never had been a hernia of the bowel. In answer to a question by Dr. Ross, Dr. Jopson stated that at the time of operation one could not say if the hernia was direct or indirect, but, judging from the history, it was probably congenital and indirect.

REVIEWS OF BOOKS.

RÖNTGEN-RAY DIAGNOSIS AND THERAPY. By CARL BECK, M.D. New York and London: D. Appleton & Co., 1904.

The author's aim in preparing this work has been to demonstrate how the Röntgen rays can best be utilized in medical and surgical practice.

The great importance of using a compression diaphragm in the production of good skiagraphs is emphasized. The diaphragm used by Dr. Beck is simple and practical, and by its aid it is possible to bring out structural details on a plate much more clearly than without it.

The author has added much to our knowledge of the usefulness of the rays in the diagnosis of biliary and renal calculi. A careful study of his results demonstrates more clearly than ever the necessity of using the very best coil and tubes if one expects to accomplish anything in this branch of the work. The characteristics of a reliable renal skiagraph, the author states, are that it shows the outlines of the psoas muscle, and the lower ribs, and the structure of the transverse processes. If they show distinctly, a calculus which is not smaller than a pea would necessarily also leave its shadow on the plate.

The chapters on Fractures and the Operative Treatment of Deformed Fracture as indicated by the Röntgen rays are especially valuable.

The illustrations throughout the book are most excellent and are well chosen. The work itself is very practical in that the subject has been treated from a strictly clinical point of view.

PAUL MONROE PILCHER.

PROGRESSIVE MEDICINE. Edited by HOBART AMORY HARE, M.D. Vol. VI, No. 1. March 1, 1904. Philadelphia: Lea Brothers & Co.

This volume contains chapters on the surgery of the head, neck, and thorax; on infectious diseases; on diseases of children; on laryngology and rhinology; on otology; and an index. All of these chapters contain articles on surgical matters.

The article on cerebral pressure analyzes the recent experiences of Kocher, Cushing, and other writers on this subject in the light of the author's own experience. The relation of cerebral pressure to the general systemic blood-pressure is receiving the attention which so important a subject merits. Kocher's four stages of intracranial pressure are clearly defined. The idea of bleeding as a therapeutic measure in cases of intracranial hæmorrhage with high-bounding pulse is purely a symptomatic one, based on the mistaken judgment that the high tension is the cause, when it really is the result of the hæmorrhage. Recent studies have shown that the high blood-pressure serves the salutary purpose of overcoming the anæmia of the bulbar centres, and preventing death from paralysis of the heart and respiration. Every surgeon should be familiar with these observations upon the effects of traumatism and hæmorrhage of the brain in their relation to blood-pressure.

Some consideration is given to the treatment of trigeminal neuralgia by the injection of osmic acid into the substance of the nerve. There is also an interesting discussion of the most recent contributions on the subject of tumors of the cerebellum.

Some idea of the value of the surgical treatment of epilepsy may be gathered from the results in thirty-three cases operated upon and reported by Spratling. These cases have been carefully followed and the results tabulated.

The subject of malignancy of the lip and tongue is discussed in the light of a large number of contributions which have recently come from English sources. One may carry away from this the

impression that the best operations are the most simple. The fancy and complicated plastic operations, preferred for cosmetic considerations, divert the operator from the main issue. Cheatle's article, calling attention to the relation between nerve distribution and carcinoma of the face, shows the relation between this disease and the trophic centres. The treatment of chronic facial paralysis by nerve anastomosis is fully discussed. This is one of the most important of the fields of modern surgery, and presents help to a large class of cases.

Tetanus is fully discussed in connection with recent literature. The use of gelatin injections as a cause of the disease and its relation to the blank cartridge are presented. The value of carbolic acid injections is exploited.

This volume is rich in surgical material. From the point of view of authoritativeness, completeness, adaptation to practical needs, good literary style, and availability for reference, the work fills a need and does great credit to all who have had a hand in its making.

JAMES P. WARBASSE.

CORRESPONDENCE.

CERTAIN POINTS IN SUPRAPUBIC PROSTATECTOMY.

EDITOR ANNALS OF SURGERY.

THE paper which was published by me in the January, 1904, number of the ANNALS OF SURGERY has received comments in two or three subsequent papers which show that the purpose of the operation there described has not been fully appreciated.

Dr. Lilienthal, in the May number of the ANNALS OF SURGERY (p. 811), in the course of some very apposite remarks with regard to suprapubic prostatectomy, with which I cordially agree, said: "The writer mentioned that in doing the suprapubic operation there was a likelihood of tearing out a part of the prostatic urethra." Dr. Lilienthal "did not think that accident would occur if the work was not done too hurriedly." The deliberate removal of the prostatic urethra was the main point upon which I desired to lay stress. It is not accidental, but purposeful. I have done many enucleations of portions of the prostate, leaving the urethra intact, but in such cases the results have not been so satisfactory as in the series of cases recorded in my paper. If the urethra be left behind at the time of operation, and a free removal of both lobes of the prostate be accomplished, I am sure that in some cases the urethra subsequently sloughs away and may be recognized after its discharge from the suprapubic wound.

Dr. J. B. Murphy, in the *Journal of the American Medical Association*, May 28, 1904, p. 1413, in a very able paper on Prostatectomy, writes, "From a perusal of his article, however, it is clear that his drainage was not satisfactory, as he frequently resorted to irrigations of the bladder with 1 per cent. carbolic acid solution." The drainage in all my cases was perfectly satisfactory. Suprapubic drainage is certainly more satisfactory than perineal

drainage in cases of enlargement of the prostate. Of this, we have been convinced since McGill's day. The reason for a daily flushing of the bladder is that in all the cases recorded in the paper, cystitis was present, often of a severe type, and the lavage was intended to hasten the return to health of the vesical mucous membrane.

Dr. Murphy further says that suprapubic leakage persisted for about seven weeks on the average. On working out in days the date of healing in this series, I find that in the eleven cases, the closure was complete, in the average, on the thirty-sixth day. In one case, owing to orchitis having occurred, the suprapubic wound did not heal till the ninety-fifth day. In my cases up to date, the average day of closure is the twenty-seventh day.

B. G. A. Moynihan.

Leeds, England.

VALUE OF PEROXIDE OF HYDROGEN.

Editor Annals of Surgery.

I wish to draw attention to the value of peroxide of hydrogen as a diagnostic help in the recognition of small malignant ulcerations in mucous membranes. I have found it of decided use in the X-ray treatment of rodent ulcers round the eye, when the conjunctiva has become involved. The whitening of the little patches which occurs on the application of the peroxide enabling me to recognize such very early, and preventing me from ceasing treatment too soon, which error I would otherwise have made.

C. M. Cooper, M.B., M.R.C.S.

San Francisco, California.

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ORIGINAL MEMOIRS.

OBSERVATIONS ON THE RESULTS IN 125 CASES OF SARCOMA.[1]

BY ANDREW J. McCOSH, M.D.,

OF NEW YORK,

Surgeon to the Presbyterian Hospital.

THE subject of sarcoma still remains a fruitful field for investigation both by the pathologist and the surgeon. We are absolutely in the dark as regards its etiology, and as to its prognosis and treatment we are but little farther advanced than were our colleagues a quarter of a century ago. Perhaps we now appreciate more fully the importance of traumatism as an occasional exciting cause. More than this, however, we cannot claim, for we must acknowledge, I think, that the painstaking and excellent work done in some of our laboratories in an endeavor to explain the etiology of malignant tumors has been rather disappointing in its results, certainly, at least, as far as sarcoma is concerned.

It is apparent, certainly to the practical surgeon, that at the present time tumors varying greatly in their characteristics are classed under the general name of sarcomata. Under this title are still included certain new growths which will probably

[1] Read in part at the New York Surgical Society, April 13, 1904.

in a few years be removed to a distinct class by themselves. We know, also, with what hesitation the pathologist pronounces upon certain growths which are merely suspicious of or resemble sarcoma. He is often at a loss to distinguish sarcoma from masses of granulation tissue or the resulting cellular tumor. I have no doubt but that in another quarter of a century the class of neoplasms now known as sarcomata will be divided into many other distinctive groups, very probably with entirely new names. It had seemed to me that our knowledge of carcinoma, at least as regards its pathology, was more definite; yet we find that the chief of the London Cancer Research Committee, Dr. Snow, has come to conclusions almost identical with the views just expressed. The endothelioma is also a puzzling variety of malignant tumor. Its exact position is still in doubt, and we do not as yet know whether to class it under the carcinomata, sarcomata, or in a distinct class of its own.

The diagnosis as well as the prognosis of any malignant tumor will always to a large extent depend on the microscopical examination. In regard to many neoplasms, such an examination is exact and trustworthy. In a large measure this is also true as regards sarcomata; but at the same time I think that most of us feel that the microscopical report in this class of tumors cannot be fully relied upon, but that the clinical picture is also sometimes needed in order to arrive at a positive decision concerning the exact nature and malignancy of the growth. As an example, let me refer to enlargements or growths of the lymphatic glands. Every surgeon is aware how unsatisfactory are often the results of the microscopical examination of such tissues. In two of the cases to be reported in the series which forms the basis of this paper, the glands removed were reported by an expert pathologist to be chronic lymphadenitis; and yet one of these patients died of sarcoma, and in the other a second examination resulted in the verdict of lymphosarcoma. There seem to be certain glandular tumors where it is apparently impossible for the pathologist to arrive

at a definite conclusion as to their exact nature, whether the growth is the result of chronic inflammation, tuberculosis, malignant lymphoma, Hodgkin's disease, or sarcoma. This whole subject is at the present day so vague and unsatisfactory, that I do not know a richer field for research, and I have been surprised that more of our younger clinicians and pathologists have not persevered in their investigations of this subject.

Another example of this difficulty in reaching a diagnosis is found in that class of neoplasms whose main structure is that of a fibroma, and yet which at the same time borders on sarcoma. The latter unquestionably develops from degeneration of the former, but in what class of fibromata this change is apt to occur we are much at a loss to understand. In the 125 cases mentioned below, the distinct diagnosis of fibroma was made in three patients who eventually developed sarcoma of a malignant type. There are also four other cases where the microscopical examination of the tumor indicated a sarcoma engrafted upon a pure fibroma. Dr. Cullen, of Baltimore, writes me that he has found such changes to occur in a considerable proportion of his uterine fibromata.

The next most important object of our search is the means of rendering a reliable prognosis. Of course, as already stated, to a large extent the basis of this must be the microscopical examination, but along with this must be studied the clinical course of the case. It seems to me that the study of such a combination, in a large series of cases, ought to throw more light than we now possess on this important subject. The difference in the degree of malignancy of sarcomatous tumors varies greatly. As we know, the progress of some cases is exceedingly rapid, so that but a few months may elapse between the first appearance of the symptoms and death. For example, in our series of cases, we find the total duration of symptoms in one case to have been but three months, and in quite a number of others less than a year.

On the other hand, the progress of some cases is very slow, so that for years the tumor may remain almost inactive,

both as regards its growth and its malignant influence on the patient's organization. Thus, in our series there are a number of cases where the tumor has increased so slowly that at the end of four or five years its size has been very moderate, also other cases where for a number of years no increase in growth has been noticed. From the statistics that follow, it will be seen that this difference in the rapidity and morbidity is to a considerable extent dependent on the variety of sarcoma to which the tumor belongs. It is not always so, however, for we find that tumors, whose structures seem to our pathologists to be practically similar, will vary greatly in both these respects. For instance, in our series we find in one patient a small round-celled sarcoma of a thigh, of a variety rightly considered to be one of the most malignant, which for a period of years developed very slowly, and yet in other patients we find tumors of the same variety producing death within a few months. Neither can it be said that this variance is due entirely to location, for we may find in two patients similar tumors of the same organ exhibiting the greatest difference in their malignancy.* It is also recognized that often the malignancy of sarcoma will vary greatly at different epochs of its existence. We encounter cases where for years the tumor may remain almost stationary, and be practically non-malignant, when suddenly it assumes a rapid rate of growth and an intense malignancy without any appreciable reason for such a change. This is especially apt to occur in the class known as fibrosarcoma. It is not uncommon for a fibromyoma of the uterus, after a dozen or more years of a benign and comparatively harmless existence, to suddenly assume the most malignant character, and on removal it is called a fibrosarcoma. The moment of this change or its cause cannot usually be ascertained.

What we as surgeons specially seek is more, however, than the name and classification of the neoplasm. We are most in search of a better means of cure than we now possess,

* Further discussion of this subject will be found in an article by Dr. George A. Tuttle and myself in the American Journal of Medical Sciences.

but that seems at present far out of our reach. We must grant, however, that sarcoma is occasionally cured by an attack of erysipelas, by Coley's toxins, by free and prolonged suppuration, and possibly by X-ray treatment or radium. Of these the most encouraging is probably Coley's toxins. It must be confessed, however, that, in spite of exceptional cures accomplished by the use of one or other of these remedies, our main reliance still lies in thorough and early removal of the tumor by operation. In the following two cases the cure which resulted was due apparently to free suppuration.

Case I.—M. J. D., female, aged thirty-two years, on February, 1892, injured her shoulder. It was thought that a fracture of the head of the bone had resulted A week or so later a tumor of considerable size developed at the shoulder, which soon after "broke," and continued to discharge a thin purulent fluid. Four weeks after the injury, a section removed proved the growth to be a small round-celled sarcoma. It was thought that amputation at the shoulder-joint would suffice; but when the humerus was disarticulated, it was found that the growth had infiltrated into the acromion process for a considerable distance, as well as into the adjoining soft parts. As permission had not been granted for a more extensive operation, after the removal of the arm the cavity was packed and the flaps loosely drawn together. There remained in the scapula as well as adjacent tissues a mass of sarcoma in bulk representing a large hen's egg. The patient would not give her consent to a complete removal of the shoulder. Consequently, a bad prognosis was given, and for a time the patient disappeared from view. When seen six months later the wound in the shoulder was thoroughly cicatrized. Suppuration had continued for about three months, at first being very free, but gradually diminishing. The patient entirely regained her health, and three and one-half years after the amputation was perfectly well. Soon after this she died of sepsis due to an abortion.

Case II.—A. L., male, aged thirty-three years. No syphilitic history. No distinct history of an injury. In May, 1888, patient began to experience abdominal pain. In August, a tumor the size of a cocoanut was discovered in the inguinal region. At operation it was found to be retroperitoneal. For two years afterwards the

patient felt well. He then experienced pains in his inguinal region, and a tumor again developed. In February, 1891, the second operation was performed, and was very extensive. The wound was left partially open, considerable gauze packing being needed on account of the bleeding. For a period of three months the sinus continued to discharge. It then healed, and the man up to March, 1900, remained perfectly well. He had gained forty pounds in weight.

CASE III.—Female, aged twenty-six. In October, 1902, a tumor the size of a grape fruit was removed by myomectomy; at the time it was thought to be a fibromyoma, December 13, 1902. The specimen consists of two solid masses of tissue hardened in alcohol. Each shows an outer envelope, five to ten millimetres in thickness, along one edge, corresponding evidently to the muscular wall of the uterus. Beneath this the tumor mass, which is about three centimetres thick, presents an irregular, somewhat cauliflower-like inner margin. None of the uterine mucosa can be recognized. Much of the cut surface of the tumor has a fasciculated appearance, as in myomata, but in general less sharply defined than in the latter. Parts of the surface are gray, homogeneous, especially near the uterine wall. Here the generally firm consistence of the growth seems to have given place, in part, to a softer consistence, indicated by a tendency to break down into irregular channels or splits, which may be artificial. There are a few small, translucent, œdematous areas.

Microscopical Examination.—The tumor is a compact mass of cells, with very little, often no intercellular, fibrillated substance. The cells are predominantly fusiform, but with much diversity in size, shape, and other features. There is no fibrous capsule of the tumor, and, although the line of separation between tumor and uterine wall appears sharp with the low power, there is more intimate relation between the peripheral tumor cells and the myometrium than is usual in myomata.

Parts of the sections, especially the central parts, have the structure of a pure myoma, being composed of interlacing bundles of smooth muscle-fibre cells with elongated, oval, nuclei containing distinct nucleoli and long, narrow, ribbon-shaped or fusiform cell-bodies staining with eosin. These cells are in close apposition, with scarcely any recognizable basement substance. There is no

tendency to the hyaline metamorphoses so common in ordinary uterine myomata.

The most interesting feature of the tumor is the transformation of the muscular into sarcomatous tissue. This transformation occurs with irregular distribution in many parts of the tumor, but is especially well marked in the periphery near the uterine wall, where whole fields show only sarcomatous cells. The metamorphosis of the muscle-cells into sarcoma cells can be clearly traced through all transitional stages, and is characterized by the substitution of the former cells by the latter There are no interstitial cells from which the sarcoma cells could be derived.

These sarcoma cells are quite polymorphous and generally have large vesicular nuclei with nucleoli. Large and small fusiform cells, angular, polyhedral cells, cells with short processes, round and oval cells, and giant cells occur. Cells with gigantic nuclei and cells with many nuclei occur, also distorted, deeply staining nuclei, vacuolated nuclei, and cystoplasm, etc. Notwithstanding this diversity of cells, the prevailing type of the sarcomatous areas is spindle-celled. A common change in the muscle-cells of the tumor is swelling of the nucleus, with increase in the diameter and diminution in the length of the cell-body, which assumes a deep eosin staining. Nuclear figures, though not abundant, can be recognized. The giant cells, which are a striking feature, seem to result from coalescence of cells. There is in general more intercellular substance in the sarcomatous than in the myomatous areas. There are a few small œdematous areas resembling mucoid tissue, and also some dilated lymphatic vessels.

The tumor is fairly rich in blood-vessels, but only the arteries and veins have a little connective tissue in their outer wall; the capillary endothelium is immediately surrounded with the tumor cells. There is a well-marked endarteritis of the vessels in the periphery of the tumor and the adjacent muscular wall of the uterus. There are no regressive, degenerative changes in the tumor cells, except as they may be indicated by the distorted nuclei with irregular staining. The muscle-cells belonging to the uterine wall take no part in the formation of the sarcoma cells, with which, however, they are in close apposition. They atrophy and undergo hyaline metamorphosis, their place being taken by the advancing tumor cells, which in this way manifest their invasive character.

Diagnosis.—Myoma sarcomatodes (sarcomatosum) uteri.

Remarks.—Virchow, in his work on tumor cells, calls attention to the transformation of myoma into sarcoma, and derived the sarcoma cells from the connective-tissue cells. The direct metaplasia of the smooth muscle-fibre cells of a myoma into sarcoma cells is now generally recognized since the investigations on this point of v. Kahlden (Ziegler's *Beiträge,* Band xiv), and especially of Whitbridge Williams (*Zeitschr. für Heilkundle,* 1894) and of Pick (*Archiv für Gynäkologie,* 1895, two articles in successive volumes). The present specimen is an excellent and very typical example of this. There is some dispute as to whether the tumor shall be called a sarcomatous or sarcomatoid myoma; for the discussion of this point, see the papers by Williams and Pick.

The tumor is likely to recur, and it may metastasize into the lungs and into the abdominal cavity. It is to be ranked as malignant.

The consideration of certain of these points can be best advanced by a detailed report of a large series of cases. The narration of an unusual case is always full of interest, and certainly adds to our knowledge; but what seems to me more instructive is the report of a man's entire experience.

It has been my endeavor in this paper to study some of the important facts concerning 125 cases of sarcoma which have been under my personal care, and from whom, either by a supposedly radical operation or by a minor procedure for mere diagnosis, a sufficient bulk of tumor has been obtained to enable the pathologist to render a positive opinion as to its character. Doubtful cases have not been included, neither have cases where, although the clinical course was characteristic of sarcoma, the microscopical examination was lacking. The examinations have all been made by clever and well-known pathologists. The great majority of the cases occurred in the Presbyterian Hospital, New York, where the examinations have been made by Dr. John Thacher and Dr. George A. Tuttle, to whose courtesy I am indebted for many of these reports. The cases number 125. These are divided according to region attacked and variety of tumor, as follows:

	Giant Cell.	Spindle Cell.	Small Round Cell.	Round Cell.	Myxosarcoma.	Lymphosarcoma.	Fibrosarcoma.	Unclassified Sarcoma.	Mixed Tumors.	Total.
Skin (single)	..	..	..	..	..	..	1	..	..	1
Scalp	..	..	..	..	..	..	2	..	..	2
Brain	..	1	4	..	..	..	1	..	..	6
Face	..	..	2	1	..	..	..	..	..	3
Facial bones (not jaws)	..	..	..	..	..	..	..	3	..	3
Superior maxilla } Inferior maxilla }	10	3	..	..	..	..	2	3	..	18
Submaxillary gland	..	..	..	..	..	..	..	..	1	1
Parotid	..	2	..	1	..	..	..	..	..	3
Larynx	..	..	1	..	..	..	..	..	..	1
Glands of neck	..	..	4	..	..	9	..	3	1	17
Thoracic wall	..	..	5	..	1	..	..	1	..	7
Breast	..	..	..	1	..	..	..	..	..	1
Axilla	..	..	3	..	..	..	..	2	..	5
Shoulder	1	..	1	..	..	..	..	..	..	2
Arm	..	..	..	1	..	..	..	..	..	1
Intraperitoneal	..	..	1	1	..	..	..	1	..	3
Retroperitoneal	..	1	..	1	..	1	2	4	..	9
Kidney	..	1	..	1	..	..	..	..	..	2
Testis	..	..	2	1	..	..	..	..	..	3
Uterus	..	2	..	..	..	..	4	2	..	8
Ovary	..	..	..	..	1	..	..	1	..	2
Spine	..	..	4	..	..	..	..	1	..	5
Nerves	..	..	..	..	..	..	..	1	..	1
Buttocks	..	..	..	..	1	..	..	..	..	1
Thigh	..	1	2	..	..	..	..	4	..	7
Leg	1	2	..	..	..	..	..	1	..	4
Toe	..	..	..	..	..	..	1	..	..	1
Multiple	..	..	..	3	..	..	1	4	..	8
Total	12	13	29	11	3	10	14	31	2	125

Sex.—Females, 60 cases; males, 65 cases.

Age.—1 to 10 years, 5 cases; 10 to 20 years, 9 cases; 20 to 30 years, 31 cases; 30 to 40 years, 41 cases; 40 to 50 years, 22 cases; 50 to 60 years, 17 cases.

The minimum age was 4½ years (small round-celled sarcoma).

The maximum, 58 years, 2 cases (1 small round and 1 fibrosarcoma).

From these figures it will be seen that the greatest number of cases occurred between the ages of thirty and forty years. This is not quite in accord with some of the notions that prevail that sarcoma mainly develops in young adults.

Out of the 125 cases, twenty-seven have been lost sight of, ninety-eight have been followed; of these, fifty-one have died of recurrence or metastasis. The average duration of life of these fifty-one patients from the appearance of the first symp-

tom until death was twenty-five months,—the maximum being ninety-six months, the minimum four months. Five other patients have recurrences or metastases, and are still alive, but are doomed to an early death. Two other patients, while free from recurrence, have too recently undergone operation to be of value in any conclusions as to prognosis. Thirty-nine patients have survived the operation for one year or longer.

Of the ninety-eight patients whose after history is known, in fifty-six the operation was considered complete. In forty-two it was recognized as incomplete. In a certain proportion of the latter, an attempt was made to eradicate the neoplasm, but was found impossible because of its extensive infiltration or adhesions. In one of these cases recovery has resulted (see Case I). In other cases removal was evidently out of the question, and in those a section was taken from the growth for microscopical examination.

Of the fifty-six complete (?) operations, fourteen have died of recurrences or metastases. Thirty-eight are alive and well at the end of a year. As already stated, one of the incomplete (?) operations has, after a period of suppuration, resulted in a cure. The details of these thirty-nine recoveries out of fifty-seven operations are as follows:

	Giant-celled Sarcoma.	Spindle-celled Sarcoma.	Small Round-celled Sarcoma.	Round-celled Sarcoma.	Lympho-sarcoma.	Fibro-sarcoma.	Myxo-sarcoma.	Mixed or Unclassified Sarcoma.	Mixed Tumors.	Total.
At end of 1 year	9	6	6	0	0	5	0	11	2	39
At end of 2 years	9	5	6	0	0	5	0	9	2	36
At end of 3 years	9	5	6	0	0	4	0	7	1	32
At end of 5 years	7	5	3	0	0	2	0	6	0	23
At end of 7 years	3	5	1	0	0	2	0	3	0	14
At end of 10 years	1	4	0	0	0	1	0	2	0	8

More detailed statistics of each variety of sarcoma follow:

Giant-Celled Sarcoma.

Cases, 12.

Deaths, 1, eighteen months after first symptom.

Unknown, 1.

Recoveries, 10.

Well at end of 1 year, 9; 3 years, 9; 5 years, 7; 7 years, 3; 10 years, 1.

Average duration of symptoms from their first appearance to operation, 12¼ months; minimum, 4 months; maximum, 24 months.

Spindle-Celled Sarcoma.

Cases, 13.

Deaths, 6. Average duration of life from first symptom till death, 23⅔ months; minimum, 8 months; maximum, 52 months.

Unknown, 1.

Recoveries, 6.

Well at end of 1 year, 6; 3 years, 5; 5 years, 5; 7 years, 5; ten years, 4.

Average duration of symptoms from their first appearance to operation, 28 months; minimum, 4 months; maximum, 60 months. Out of 7 complete operations, 6 recovered, 6 died.

Small Round-Celled Sarcoma.

Cases, 29.

Deaths, 18. Average duration of life from first symptom till death, 25 months; minimum, 6 months; maximum, 96 months.

Unknown, 4.

With recurrence, nearly dead 32 months after operation, 1.

Recoveries, 6.

Well at end of 1 year, 6; 3 years, 6; 5 years, 3; 7 years, 2.

Average duration of symptoms from their first appearance to operation, 9½ months; minimum, 1 month; maximum, 72 months. Out of 11 complete operations, 5 recovered, 6 died.

Round-Celled Sarcoma.

Cases, 11.

Deaths, 5. Average duration of life from first symptom till death, 22 months; minimum, 12 months; maximum, 37 months.

Unknown, 4.

With recurrence, but alive, 2.

Recoveries, 0. Three only of these operations were judged to be complete.

Lymphosarcoma.

Cases, 10.

Deaths, 4. Average duration of life from first symptom till death, 26 months; minimum, 9 months; maximum (two operations), 52 months.

Unknown, 4.

Alive and well 2 months after operation, 2.

Recoveries, (?) or 0.

Two only of these operations were judged to be complete.

Myxosarcoma.

Cases, 3.

Deaths, 2. Average duration of life from first symptom till death, 49 months; respectively, 38 and 60 months.

Unknown, 1.

Recoveries, 0.

One only of these operations was judged to be complete.

Fibrosarcoma.

Cases, 14.

Deaths, 3. Average duration of life from first symptom till death, 22 months; minimum, 14 months; maximum, uncertain, as history of skin tumors for 21 years.

Unknown, 5.

Well, 2 months after operation, 1.

Recoveries, 5.

Well at end of 1 year, 5; 3 years, 4; 5 years, 3; 7 years, 2; 10 years, 1.

Average duration of symptoms from their first appearance till operation, 25⅓ months; minimum, 3 months; maximum, 60 months. Seven only of these operations were judged to be complete.

Mixed Unclassified Sarcoma.

Cases, 31.

Deaths, 12. Average duration of life from first symptom till death, 16 months; minimum, 4½ months; maximum, 40 months.

Unknown, 7.

With recurrence, but alive, 1.

Recoveries, 11.

Well at end of 1 year, 11; 3 years, 7; 5 years, 6; 7 years, 3; 10 years, 2.

Average duration of symptoms from their first appearance till operation, 13 months; minimum, 3 months; maximum, 60 months. Fifteen only of these operations were judged to be complete.

Mixed Tumors.

Cases, 2.

Deaths, 0.

Recoveries, 2.

Well at end of 25 months, 1; 50 months, 1.

DURATION OF LIFE IN FATAL CASES FROM APPEARANCE OF FIRST SYMPTOM TILL DEATH.

	No.	Average.	Minimum.	Maximum.
Giant-celled sarcoma	1	18 months.		
Spindle-celled sarcoma	6	23⅓ months.	8 months.	52 months.
Small round-celled sarcoma	18	25 months.	6 months.	96 months.
Round-celled sarcoma	5	22 months.	12 months.	37 months.
Lymphosarcoma	4	26 months.	9 months.	26 months.
Myxosarcoma	2	49 months.	38 months.	60 months.
Fibrosarcoma	3	22 months.	14 months.	?
Mixed or unclassified sarcoma	12	16 months.	4½ months.	40 months.

While many of the above cases present features of interest, it is not the object of this paper to record individual cases. Of a few organs, however, there have been a sufficient number of cases of sarcoma to warrant the more detailed statements of the results of operation. Of the jaw there are eighteen cases; of the lymphatic glands of the neck, seventeen cases, and of the lower extremity, twelve cases. In this connection, it may be of interest to refer to a successful operation on a patient with a small round-celled sarcoma of the brain, who at the present

time, thirty-eight months after operation, is perfectly well. (*Presbyterian Hospital Reports,* Vol. v.) Also to a successful operation for a small round-celled tumor of the spinal cord, the patient being now, more than four years after operation, perfectly well. (*The Journal,* August 31, 1901.)

Sarcoma of Jaws.—These cases are divided into two classes: (1) where the sarcoma affected the body of one or other jaw, necessitating its partial or complete removal; (2) so-called epulis of sarcomatous nature, where but the alveolar process and gum were affected. Several cases of epulis which showed mainly a fibrous or connective-tissue structure are not included. Out of eighteen operations, it will be noted that there was no death following soon after operation. Two cases have disappeared; but one case, and that a spindle-celled sarcoma, has died of recurrence at the end of four years. As to the ultimate results, at the end of three years twelve cases are perfectly well; eight of these are giant-celled, one spindle-celled, one fibrosarcoma, and two are of the mixed variety, mainly small round and spindle-celled. Eight cases have survived seven years or more, and three cases more than ten years.

I.—INFERIOR MAXILLA. FIVE CASES. OPERATIVE MORTALITY, 0.

No.	Name.	Sex.	Age.	Symptoms.	Excision.	Variety of Sarcoma.	Result.
1	M. E. F.	F.	22	12 months.	⅓ inferior maxilla.	Small and spindle-celled.	Well, 15½ years later.
2	M. M. F.	F.	21	4 months.	½ inferior maxilla.	Spindle-celled.	Well, 16 years later.
3	A. W. F.	F.	19	6 months.	½ inferior maxilla.	Giant-celled.	Well, 8½ years later.
4	J. B.	F.	37	2 months.	⅓ inferior maxilla.	Fibro-, spindle-, and small-celled.	Well, 4½ years later.
5	A. E.	F.	37	9 months.	½ inferior maxilla.	Giant-celled.	Well, 3½ years later.
6	L. K.	F.	24	3 months.	⅓ inferior maxilla.	Giant-celled.	Well, 2¾ years later.

SUPERIOR MAXILLA. FIVE CASES. OPERATIVE MORTALITY, 0.

No.	Name.	Sex.	Age.	Symptoms.	Excision.	Variety of Sarcoma.	Result.
1	B. J.	F.	12	12 months.	Left superior maxilla.	Giant-celled.	Well, 11 years later.
2	B. N.	M.	44	24 months.	Right superior maxilla.	Spindle-celled.	Well, 1 year later.
3	C. H.	M.	34	14 months.	Right superior maxilla.	Giant-celled.	Well, 3 months later.
4	T. N.	M.	45	6 months.	Left superior maxilla.	Spindle-celled.	Death in 4 years.
5	A. S.	F.	18	3 months.	Right superior maxilla.	Giant-, round-, and small-celled.	Unknown.

II.—Epulis. Seven Cases. Operative Mortality, 0.

No.	Name.	Sex.	Age.	Symptoms.	Excision.	Variety of Sarcoma.	Result.
1	E. C.	F.	19	5 months.	On superior maxilla.	Giant-celled.	Well, 8 years later.
2	M. O.	F.	26	36 months.	On inferior maxilla.	Giant-celled.	Well, 6 years later.
3	H. M.	F.	20	12 months.	On inferior maxilla.	Giant-celled.	Well, 5 years later.
4	B. L.	F.	8	4 months.	On inferior maxilla.	Giant-celled.	Well, 5 years later.
5	J. H.	M.	21	7 months.	On superior maxilla.	Fibro-celled.	Well, 4 years later.
6	L. H.	F.	31	6 months.	On superior maxilla.	Giant-celled.	Unknown.
7	L. S.	F.	31	3 months.	On inferior maxilla.	Fibro-celled.	Unknown.

Sarcoma of Lymphatic Glands of Neck.—The cases number seventeen. In eight only has the operation been considered more or less complete. In the other nine the disease was too extensive for removal.

Of the seventeen cases, the results are, Deaths from recurrence, 8; recoveries, 3; unknown, 4; too recent operation, 2.

The after history is known in four only of the supposedly complete operations; three of these are well at eight and one-half, five, and four and one-half years respectively; one died of recurrence fourteen months after operation.

In these seventeen cases, nine were lymphosarcomata, and not one of these is known to have recovered. This observation exactly corresponds to that of other surgeons.

Sarcoma of Neck. Seventeen Cases. Operative Mortality, 0.

No.	Name.	Sex.	Age.	Duration of Symptoms.	Operation.	Variety of Sarcoma.	Ultimate Result.
1	J. M.	M.	27	1 month.	Extensive.	Small, round.	Well, 8½ years later.
2	M. K.	F.	24	24 months.	Extensive.	Small, round, mixed tumor.	Well, 5 years later.
3	P. R.	M.	26	3 months.	Extensive.	Sarcoma, adenoma, and carcinoma.	Well, 4½ years later.
4	T. B.	M.	26	72 months.	Incomplete.	Small, round.	Death, 11 months later.
5	L. P.	M.	30	32 months.	Incomplete.	Lympho.	Death, 1 month later.
6	A. Z.	M.	40	2 months.	Incomplete.	Round and spindle.	Death, 5 months later.
7	W. H.	M.	24	36 months.	Complete (?).	Lympho.	Death, 14 months later.
8	E. C.	M.	24	8 months.	Incomplete.	Lympho.	17 months after first operation: death, 14 months after second operation.
9	Mrs. C.	F.	57	2 months, secondary to uterus.	Incomplete.	Small, round.	Death, 1 month later.
10	M. H.	F.	44	4 months.	Incomplete.	Unclassified.	Death, 3 months later.
11	E. N.	F.	50	3 months.	Incomplete.	Lympho.	Death, 4 months later.
12	A. S.	F.	47	36 months.	Extensive.	Unclassified.	Unknown.
13	M. A.	F.	30	6 months.	Incomplete.	Lympho.	Unknown.
14	L. B.	F.	36	1 month.	Extensive.	Lympho.	Unknown.
15	E. S.	F.	44	12 months.	Complete.	Lympho.	Unknown.
16	A. A.	F.	22	24 months.	Complete.	Lympho.	Too recent date.
17	H. S.	M.	54	18 months.	Incomplete.	Lympho.	Too recent date.

Sarcoma of the Lower Extremity.—The subject of the sarcomata of the long bones has for years received considerable attention from surgeons, and especially is this true of the bones of the lower extremity. In this connection two questions are of importance. First, as to the choice in certain cases between resection and amputation. Mikulicz and a few other surgeons of reputation are in favor, in certain properly selected cases, of resection in preference to amputation. The majority of surgeons recommend amputation in all cases. There can be no doubt, however, but that the results of a few resections have been most satisfactory. I am not inclined to favor this procedure; but perhaps in certain encapsulated giant-celled sarcomata it may be an appropriate operation. The existence of encapsulation is, however, a very difficult point to determine, so difficult to my mind is it that I have never yet seen a case whose interests I felt could be best served by a resection in preference to an amputation.

The second question is whether in every case it is necessary to remove the limb at the joint next above the disease, or whether it is not often sufficient to simply amputate well above the seat of the sarcoma. For instance, in a sarcoma of the lower end of the femur, is the operation of choice disarticulation at the hip-joint, or amputation at the upper part of the thigh? We need more light on this subject; but I am inclined to believe that the lesser operation is often preferable, and equally as safe.

It will be seen that there have been 11 amputations of the thigh, for sarcoma of the femur, or head of the tibia or fibula. There have been no deaths due to the operation. One patient has disappeared. Of the 10 other patients, 5 have died of metastases or recurrences,—2 at the end of 12 months; 1 at the end of 8 months; 1 at the end of 6 months; 1 at the end of 3 months. There are alive and well, 4 years after operation, 5 cases; 5 years after operation, 4 cases; 10 years after operation, 2 cases. Of the 5 cases who have survived 4 years or more, in 2 the sarcoma was spindle celled, in 1 giant and round celled, in 1 fibro and spindle celled, and in 1 giant and spindle celled.

It will be seen that of the 7 cases of sarcoma of the femur, 4 have died of recurrence, 3 are well from 4½ to 12 years after operation.

SARCOMA OF THIGH. SEVEN CASES. OPERATIVE MORTALITY, 0.

No.	Name.	Sex.	Age.	Duration of Symptoms.	Operation.	Variety of Sarcoma.	Ultimate Result.
1	P. O.	M.	34	4 months.	Hip-joint disarticulation.	Spindle.	Well, 12 years later.
2	H. W.	F.	35	6 months.	Hip-joint disarticulation.	Giant, spindle, and round.	Well, 5½ years later.
3	W. K.	M.	23	9 months.	Hip-joint disarticulation.	Fibro and spindle.	Well, 4½ years later.
4	G. F.	M.	32	12 months.	Hip-joint disarticulation.	Small, round.	Death, 1 year later.
5	W. B.	M.	22	8 years.	Hip-joint disarticulation.	Small, round.	Death, 8 months later.
6	M. A.	M.	15	4 months.	Hip-joint disarticulation.	Spindle and giant.	Death, 1 year later.
7	A. T.	F.	27	12 months.	Amputation below trochanter.	Fibro and spindle.	Death, 3 months later.

SARCOMA OF LEG. FOUR CASES. OPERATIVE MORTALITY, 0.

No.	Name.	Sex.	Age.	Duration of Symptoms.	Operation.	Variety of Sarcoma.	Ultimate Result.
1	J. C.	M.	35	Injury, 22 months.	Middle thigh amputation.	Spindle.	Well, 13 years after.
2	F. A.	M.	25	15 months.	Middle thigh amputation.	Giant and spindle.	Well, 5½ years after.
3	M. K.	F.	18	4 months.	Below trochanter.	Spindle.	Death, 6 months after.
4	D. H.	F.	30	Injury, 22 months.	Middle thigh.	Giant.	Unknown.

THE COMBINED TRANSVERSE AND LONGITUDINAL INCISION IN LAPAROTOMY.[1]

BY LEWIS A. STIMSON, M.D.,

OF NEW YORK,

Surgeon to the New York Hospital.

At a meeting of the New York Surgical Society in December, 1900, I presented several patients whose abdomens I had opened by a combined transverse and longitudinal incision, that procedure having been selected with a view to the avoidance of a subsequent hernial protrusion at the scar. (See Annals of Surgery, April, 1901.)

A year later, December, 1901, I prepared a short paper upon the subject, which was published in the *Medical Record,* June, 1902, the delay in publication having been caused by circumstances not under my control.

My purpose in bringing the subject to notice again is to acknowledge, what, of course, I was not aware of at the time of presentation and publication, that I had been anticipated in both performance and publication, to trace the origin and development of the method, and again to ask attention to what I conceive to be the great advantages of the method, and to report the results of my subsequent experience with it.

The literature bearing upon the origin of the plan is as follows: The Report of the International Congress on Gynæcology and Obstetrics at Geneva, August, 1896, and an abstract thereof in *La Presse Médicale,* 1896, p. 480; a short paper by Küstner in the *Monatschrift für Geburtshilfe und Gynäkologie,* September, 1896, p. 197, abstracted in the *Centralblatt für Chirurgie,* 1897, p. 231, and in the *Centralblatt für Gynäkologie,* 1897, p. 271; a long paper by Pfannenstiel in Volkmann's Sammlung klin. Vorträge, Gynäkologie, No. 97, N. F., p. 268, issued in February, 1900; a thesis, " De l'incision cruciale dans

[1] Read before the New York Surgical Society, March 23, 1904.

la laparotomie," by Naudet, Paris, 1900, containing a report of Professor Hartmann's cases; and my report already mentioned, December, 1900. Other papers treating of the subject and reporting cases have been published by Dartigues, *Presse Médicale,* October, 1899, p. 202; Cumston, *Annals of Gynäkologie,* October, 1901, and Menge, *Centralblatt für Chirurgie,* August, 1903, p. 954.

Two ideas, widely separated in the objects sought, but clearly connected by suggestion, appear as the originating impulse in these papers.

The first was that of making a transverse incision through the skin alone at or within the margin of the pubic hair, and following it with the usual longitudinal incision along the linea alba, for the sole purpose of obtaining an inconspicuous scar. Its first public mention was by Küstner at the Geneva Congress, and it was embodied in his paper in the *Monatschrift für Gebürtshilfe* published the following month. In this paper he states that he had employed the method eight times in the preceding three weeks, and he supports his recommendation of its use by the argument that many patients will accept a vaginal operation, while they refuse one through the anterior abdominal wall because of the evident scar left by it. A day or two later, in the Congress, Rapin, of Geneva, referred to Küstner's statement, and said that he himself had employed the same method in seven cases during the preceding two years with the same object, namely, to diminish the scar. Dartigues, 1899, reports Segond's use of the method, and Cumston reports a personal experience with it in about forty-five cases. All speak only of the minimizing of the cutaneous scar as the object, and all deem it applicable only to operations that can be accomplished through a small opening in the abdominal wall.

The second idea is that of obtaining a firmer reunion of the divided wall, of preventing hernia in the scar line, by carrying the transverse incision not merely through the skin, but also through the aponeurosis of the external oblique and the anterior layer of that of the internal oblique, the " sheath

of the rectus," and confining the longitudinal incision to the separation of the recti and the division of the peritoneum.

Pfannenstiel was the first to operate in this way and to publish his results. It is singular that his long and elaborate paper, with so important an idea as the better prevention of hernia for a text, a subject so frequently discussed, should not have been mentioned in the periodical reviews, while Küstner's paper, covering only a page and dealing only with a cosmetic object, should have been abstracted in two of them.

Pfannenstiel reported that he had employed the method for two years, in fifty-one cases. His technique is essentially that employed by later users of the method, and the only point at which an advance has been made is in the greater extension given to its range of applicability. He would restrict it mainly to operations of relatively slight extent upon the uterine appendages, although declaring that hysterectomy is possible. He states that the idea was suggested to him by Küstner's article, 1896.

In like manner the idea had been suggested to me by the reprint of Küstner's article in the *Centralblatt für Chirurgie* in 1897; and to carry the transverse incision through the aponeurosis and sheath—thus applying to the operation the principle of McBurney's intramuscular operation upon the appendix and securing the great advantages with which we are all so familiar —seemed so natural a suggestion that, as stated in my article in the *Record,* I thought it must have occurred to and perhaps had been put into practice by others. The suggestion remained dormant until my interest was aroused by observation of two or three cases of postoperative ventral hernia in the autumn and winter of 1899, and the first application of it was made in a case of pyosalpinx admitted to the Hudson Street Hospital, March 12, 1900. Pfannenstiel's publication was made the preceding month, but did not come to my knowledge until two years later. It establishes his priority of execution and publication, and I can lay claim only to independent conception.

Another surgeon, Professor Hartmann, of Paris, conceived the method independently, and first made use of it in

May, 1900. He made no publication of it under his own name, but followed a common French custom, and gave it to the public through the graduating thesis of one of his students, Naudet. This thesis bears only the date "1900," but as one of the five cases therein reported underwent operation on November 15, 1900, it is not probable that it was published before December.

It is not categorically stated in the thesis that Professor Hartmann's conception of the method was original with him, but as Pfannenstiel's paper is freely quoted from, and as there is no essential or even important difference in the technique, no other reason appears for associating his name so closely with it.

To summarize it: Rapin was the first to substitute a transverse incision through the skin for a cosmetic purpose; Küstner conceived the same plan independently about two years later, and was the first to publish it. Pfannenstiel was the first to plan, execute, and publish the method of a transverse incision through the aponeuroses for the purpose of maintaining the solidity of the abdominal wall and preventing postoperative hernia.

But a matter of much more general interest is the availability, the efficiency, of the operation. Are its results such as are claimed for it? does it permit an adequate exposure of the abdominal cavity? has it disadvantages which offset its advantages?

These questions can be answered only by the test of experience in many hands; and evidence is accumulating that the test is rapidly making, if not already made. My own use of it has been continuous in two hospitals, and of late exclusive whenever there has been occasion to open the lower segment of the abdomen widely, in the male as well as in the female. Three of my colleagues at the New York Hospital have also used it freely, but only, I believe, in operations upon the appendages. A few have used it with increasing frequency and satisfaction in other hospitals in this city. Dr. Charles G. Cumston, of Boston, wrote me last September that he had employed it in 247 cases, and that it was used by others in that city; and

I have been told that it is to be frequently seen in some of the German clinics.

Menge (*Zentralblatt für Chirurgie,* 1903, p. 954) reports thirty-two cases of its use in operations upon the uterus and its appendages, and thinks it will greatly restrict the use of colpotomy and median abdominal section. Among its advantages he counts a greater protection of the intestines from exposure and easier access to the præuterine space; and while he thinks Douglas's pouch is not so easily reached, yet he found no difficulty in doing all therein that needed to be done. Apparently he had not employed it in any case of uterine carcinoma or large solid tumor. And although all his wounds healed *per primam,* he thinks the chance of infection and suppuration of the parietal wound may be greater than with the median incision.

My personal experience covers its use in at least 150 cases. The great majority were operations upon the uterine appendages, but the list includes several total and supravaginal hysterectomies for fibroid and carcinoma, several ectopic gestations, two cases of gunshot wound of the intestines, both recovering, resection of the intestine, intestinal obstruction, and a few explorations. Of the results of that experience, I beg to speak briefly.

The first step—the opening of the abdomen—requires a little more time than does the median incision, and so too may its closing. But the total excess is small, not more than five minutes. The line of the incision is a shallow curve, concavity upward, and crosses the median line three or four centimetres above the symphysis pubis. The sides extend towards the anterior superior spines, but stop well short of them, the extent depending upon the purpose of the operation and the amount of fat in the abdominal wall. Sometimes a total length of three inches is sufficient. When the incision needs to be lengthened, either at the beginning or in the course of the operation, I make the prolongation more upward than outward.

The aponeurosis of the external oblique, having been exposed throughout, is divided in the line of the incision, as is

also that of the internal oblique or "sheath of the rectus." The knife may be used for this, or, very conveniently after the division of the central portion, the scissors. Occasionally, the muscular fibres of the internal oblique extend further inward than usual, overlying the outer portion of the rectus, and are involved in the cut. Then lifting the central portion of the aponeurotic flap with forceps, it is freed upward with the knife along the linea alba and the outer border of the pyramidales until those muscles have been passed, then rapidly freed on each side from the rectus by stripping with the fingers, and the separation along the median line is completed with the knife, taking care to keep the edge close to the surface of the muscle so as not to thin or possibly button-hole the flap. One or two arteries running from the rectus to the aponeurosis need to be secured; except for these, the separation of the flap is bloodless. I generally plan not to carry the incision of the aponeurosis beyond the outer border of the rectus, and, if more room is needed, to extend it along that border upward rather than transversely.

The flap is then drawn sharply upward, and the abdomen opened in the median line in the usual manner. It is easy to extend this separation of the flap and the median opening to the umbilicus, but, of course, that cannot be passed.

I have thought that, length for length, the median incision thus relieved from the lateral resistance of the aponeurosis gives a wider opening and freer access to the abdomen than when made in the usual manner.

In two or three of my earlier cases, where more room seemed needed, I split the flap in the median line and prolonged the incision upward. This tardy abandonment of the plan and reversion to the old method was accomplished with ease; and the only cost to the patient—the superfluous transverse incision and the stripping-up of the flap—led to no recognizable ill results.

Occasionally, when the umbilicus was unusually high and much room would surely be needed, I have made the transverse incision about an inch higher than above described, and have

secured some additional space by a short median cut in the aponeurosis downward towards the symphysis.

The operation having been completed, the wound is closed by suture of the peritoneum and of the aponeurotic layer posterior to the recti wherever it can be readily identified and secured; and if the recti tend to fall apart, two or three points of suture may be placed in them. The aponeurotic flap is secured in place by chromic catgut sutures for an inch or two on each side of the median line, and the remainder by plain catgut, interrupted or continuous. Sometimes I unite the two layers separately, and sometimes (especially if anxious to save time) include them in the same sutures. It seems to be a matter of indifference whether or not their exact reunion is effected, since the pull of their muscles has little or no tendency to separate the sides of the incision. The skin is closed as usual.

I have generally drained the space beneath the aponeurotic flap for a day or two with rubber-tissue strips introduced on either side.

When drainage of the abdominal cavity was needed, and was not provided for through the vagina, I have drained at the centre of the incision; and, although in several cases such a drain has been long maintained, I have seen no hernial protrusion result. I anticipated at first that infection and suppuration beneath the flap would frequently result in cases in which the operation was done because of suppurative conditions, but such a result has been very infrequent, and when such suppuration has ensued it has been limited to the neighborhood of the median line.

The scar has been inconspicuous and freely movable in all except one case, and has shown very little of that broadening which is so common after median incision. In that case, a very fat woman, the scar retracted deeply.

In no case has any weakness of the abdominal wall, any tendency to hernial protrusion, manifested itself; and a consideration of the anatomical conditions and of the factors productive of such weakness seems to justify the confident antici-

pation of its absence. The scar of the longitudinal portion of the incision is not subjected to the pull of the lateral muscles, which is so important a factor in widening that left by a median incision through the aponeurosis, and the action of intestinal distention is efficiently met by the aponeurotic sheet unbroken except where it is guarded by underlying muscle.

In a case in which the operation was repeated after a few months, I found the aponeurotic flap not only solidly reunited along the incision, but also strongly attached to the tissue between the recti, and the latter was noticeably thicker than at first.

The cosmetic element I leave without comment. It seems unimportant, and yet several have mentioned it as sufficient to win the consent of a patient to the operation.

In conclusion, I feel justified in recommending the method as one that is easy of execution, ample for any abdominal work that can be done through a median incision below the umbilicus, easy of repair, and affording apparently complete protection against postoperative ventral hernia.

PEPTIC ULCER OF THE JEJUNUM.

BY A. W. MAYO ROBSON, F.R.C.S.,

OF LONDON.

THE subject of peptic ulcer is an extremely interesting one that has given rise to much speculation and to many theories.

In the stomach it is extremely common, in the duodenum probably much more frequent than hitherto supposed, but in the jejunum it is generally acknowledged to be very rarely found; in fact, it is only four years since Braun first described the formation of peptic ulcer in the jejunum of man, and, although the subject has received some attention in Germany,—Braun, Hahn, Kausch, Körte, Kocher, and others having described cases,—this is I believe the first case described in English literature.

In a paper describing a peptic jejunal ulcer following on gastro-enterostomy in a dog, Dr. S. H. Watts has collected and tabulated fourteen cases. I have heard of another which has not yet been published, and my own would make the sixteenth case; but as all of these cases were perforating ulcers, it almost goes without saying that there must be many more that have existed unrecognized, and probably many others that have caused death by abscess and in many other ways, in which the adhesions and other complications have so obscured the parts that even an autopsy has failed to elucidate the true nature of the disease.

The true cause of peptic ulcer, whether gastric, duodenal, or jejunal, is probably a mild form of sepsis leading to gastritis and excess of free HCl in the gastric juice, though traumatism, either by coarse food or through external injury and interference with the circulation in the bowel, has been

ANALYSIS OF REPORTED CASES.

Reference.	Operation, Anterior or Posterior.	Gastric Acidity.	Operation for	Number of Cases.	Number of Ulcers.	Time after Operation.	Result.
Braun	Posterior.	Normal.	Dilated stomach.	1	1	1 year.	Perforation ; peritonitis ; death.
Hahn.....	All anterior.	All cases. +	Benign stenosis of pylorus.	3			1st case, perforation and death. 2d and 3d cases, abscess ; operation ; cure.
Kausch	All anterior.	2 cases. + 1 case normal.	1st and 2d, pyloric stenosis. 3d, ulcer of stomach.	3	1st and 2d cases, 1 each. 3d case, ulcer recurred.	1st case, 4 months. 2d and 3d cases, ?	1st and 2d cases, perforation ; abscess ; operation ; cure. 3d case, recurrence of ulcer ; jejunostomy ; death.
Körte	Anterior.	+	Gastric ulcer.	1	1	3 years.	Perforation ; peritonitis ; death.
Steinthal...	Posterior.	+	Pyloric stenosis.	1	4	10 days.	Perforation ; death.
Neumann ..	Anterior.	+	Functional. Pyloric stenosis.	1	1	3 to 4 months.	Perforation ; abscess ; operation ; cure.
Kocher	Y of Roux,	—	Gastric ulcer.	1	1	12 months.	Perforation ; abscess ; operation ; cure.
Heidenhain.	Anterior.	Normal.	Pyloric stenosis with ulcer.	1	1	3 to 4 months.	Perforation ; adhesions ; operation ; cure.
Goepel.....	Anterior.	Both. +	Pyloric stenosis. Gastric dilatation.	2	1 each.	4 months. 13 months.	1st case, perforation ; death. 2d case, perforation ; suture ; cure.
Mayo Robson, May 5, 1903..	Anterior.	+	Hæmatemesis due to gastric ulcer.	1	?	3 years and 4 months.	Perforation ; adhesions ; enterectomy ; Roux's operation ; recovery.
Quenu, June, 1901.....	Anterior.	+	Stenosis of pylorus.	1	?	4 years.	Ulceration ; adhesions ; enterectomy ; Roux's operation ; cure.

assigned as a cause, but without what seems to me adequate reasons.

Peptic ulcer is distinctly one of the sequelæ to be reckoned with after gastro-enterostomy, though it seems much more likely to occur after the anterior than the posterior operation.

It is curious that, so far as we know, it does not occur after pyloroplasty; but whether the operation of Finney, which makes a much more extensive opening, will be followed by peptic duodenal ulcer, time alone will prove.

As regards the frequency of peptic jejunal ulcers, out of 136 posterior gastro-enterostomies which I have personally performed I have not had one example, nor has one occurred among 100 posterior gastro-enterostomies operated on by a colleague.

My case occurred after an anterior gastro-enterostomy, one out of thirty that I have performed, and Kausch reported two out of 160 gastro-enterostomies performed in Professor Mikulicz's clinic, both being after anterior gastro-enterostomies.

Of the cases in the table, the anterior operation had been done in eleven, the posterior in two, and the Y operation of Roux in one; but whereas, in the two cases of peptic ulcer occurring after the posterior operation, perforation was followed by general peritonitis, in the eleven anterior operations the peritonitis was limited in eight and diffuse only in three.

The symptoms in my case were evidently chiefly referable to the perigastritis and the extensive adhesions, and, although there was intense and agonizing pain at times, it seemed to bear no relation to food.

Vomiting did not occur, nor was the loss of flesh very marked, but hæmorrhage was a distinct feature, and the presence of a well-marked tumor at the site of perforation is to be noted.

Treatment.—Though well recognized, I think it has not been sufficiently grasped that the essential cause of peptic ulcers is of a septic nature, and in many cases the source of the trouble is oral; hence, probably the greater frequency of

gastric ulcer among the poorer classes. The sequence of events being septic gastritis, hyperchlorhydria, and ulceration.

In the cases of gastric ulcer that have failed to yield to medical treatment and in which gastro-enterostomy has been performed, I fear that we have not properly grasped the fact that the operation is, though an important one, still only an incident in the treatment, which ought to be continued on general lines for some time longer or until good health is again established. Greater attention to oral asepsis and to the gastric condition of hyperchlorhydria subsequent to operation is advisable, and in this way the very serious complication of peptic ulcer in the jejunum and relapses in gastric ulcer might be prevented.

In all the cases reported, perforation, associated with acute, subacute, or chronic symptoms has occurred, as will be seen by referring to the tabulated list; hence there can be no question as to the desirability, nay, as to the absolute necessity, of operation, which ought not to be delayed too long. When the abdomen is opened, the treatment will depend on the condition found.

If perforation has occurred into the general peritoneal cavity the condition will be one of the utmost peril, and only capable of relief by immediate cleansing of the peritoneum and closure of the opening, or by excision of the ulcer with subsequent suture.

Though peptic ulcer of the jejunum is frequent after posterior gastro-enterostomy, only two cases having been recorded, when it does occur it is more likely to be acute and not to lead to adhesions.

If, as in the greater number of cases, adhesions have formed, the condition will be less acute, although very distressing, from the associated pain due to perigastritis and adhesions. It will be necessary to detach adhesions and to repair the perforation, but probably in the greater number of cases an excision of the portion of intestine involved and the performance of a Roux's operation will give the best results.

CASE.—*Peptic Ulcer, occurring in Jejunum Three Years and Four Months after Gastro-enterostomy, treated by Enterectomy and Roux's Operation; Recovery.*

Mr. C., aged forty-four years, was sent to me by Dr. Peter MacGregor, of Huddersfield, on January 2, 1900, with the history that he had had pain after food, together with other symptoms of gastric ulcer, for four years, though his first attack of vomiting blood occurred in May of the previous year. The bleeding was rather profuse, but under medical treatment and rest he recovered and was able to resume his occupation. A week before he was sent, there had been a recurrence of the hæmorrhage, which was repeated three days later.

On his arrival at the surgical home he was in a state of collapse, with a barely perceptible pulse. There was well-marked dilatation of the stomach, with tenderness over the pylorus. The history of the pain occurring one and a half hours after food, together with the site of the tenderness and the presence of a large amount of blood in the motions, left no doubt but that the ulcer was at or near the pylorus. As the bleeding had recurred twice in the week, and was persisting and passing into the bowel, operation was decided on. This was done on January 4, 1900. As the patient was in such a feeble condition, every precaution was taken to guard against shock, and it was decided only to perform gastro-enterostomy, as it was quite clear that he would not stand any prolonged search for the bleeding point. An anterior gastro-enterostomy was done, a decalcified bone bobbin being used to make the anastomosis, the opening being made close to the lower border of the stomach. The pylorus and first portion of the duodenum were very much thickened, evidently the result of ulceration. His temperature and pulse were never above normal, and he made an uninterrupted recovery. He was fed by nutrient enemata for the first few days, only taking sips of water by the mouth; but at the end of that time he was allowed to take milk and soda water, and then gradually to have stronger food. He was up at the end of the third week and returned home within the month.

The patient remained well for two years, and had neither pain after food nor vomiting. He gained his normal weight and was able to do his work. After this he began to have pain at the epigastrium. The pain seemed to bear no relation to food and

was unaccompanied by vomiting. There was marked tenderness at the epigastrium, especially on the left of the middle line. At times the pain was so acute as to cause him to roll on the floor and to perspire profusely. At first the attacks were not very frequent, only coming on at intervals of a month or two, but recently they had been more frequent, almost daily, and during the week before I saw him dark blood had been noticed in the motions on several occasions.

He was sent to me by Dr. James Hall, on May 5, 1903, when a well-marked tumor was found occupying the epigastrium and decidedly tender to pressure, but there was no vomiting and no sign of stomach dilatation could be discovered. Tarry matter was seen in the motions.

The diagnosis of thickening around a chronic ulcer and perigastritis was made and an exploratory operation advised. The abdomen was opened by an incision just to the right of the middle line, and the stomach was found adherent to the anterior abdominal wall, one inch to the left of the old scar. On separating the adhesions it was found that ulceration had occurred at the point of junction between the bowel and the stomach, and that it had involved the whole circumference of the jejunum at that point, the ulceration having completely extended through the intestinal wall at the front, but this must have occurred after adhesions, so that there had been no acute symptoms of perforation. Through the opening left when the adhesions had been separated, the finger was passed into the stomach, when it was found that the pylorus had quite closed as a result of the ulceration three years before, so that nothing could have passed through it. On passing the finger into the intestine, extensive ulceration and thickening were discovered. The ulcerated portion of the bowel was completely excised and then separated from the opening in the stomach, the edges of which were pared, the distal end of the jejunal loop was implanted into the old opening in the stomach, the union being effected over a bone bobbin, the proximal end was implanted into the jejunum about four inches lower. This union was also effected over a bone bobbin.

The accompanying drawings show the site of the perforation, the base of the ulcer taken from the anterior abdominal wall, the portion of intestine excised, and the intestinal anastomosis that was adopted.

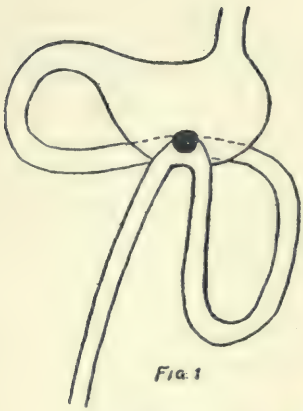


FIG. 1



FIG. 2.



FIG. 3

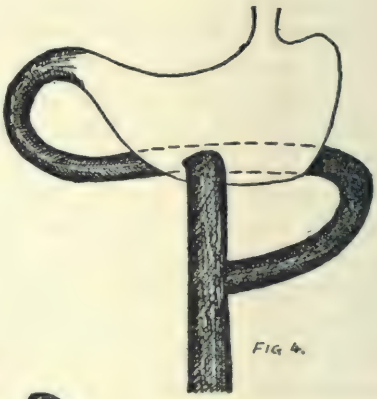


FIG. 4.

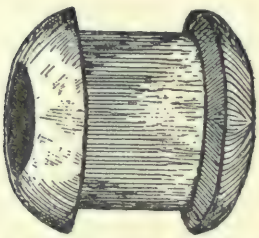


FIG. 5.

FIG. 1.—Diagram of condition found on separating adhesions, May, 1903, showing perforation.

FIG. 2.—Diagram of portion of ulcer adherent to and detached from anterior abdominal wall.

FIG. 3.—Diagram of portion of intestine excised.

FIG. 4.—Diagram of anastomosis performed after the enterectomy.

FIG. 5.—Size of bobbins used.

The patient made a steady recovery, so that on June 2 the following note was made: "The patient is now quite well and is entirely free from his old pain. The wound has completely healed by first intention." He returned home on June 2.

When seen by his medical man at home on June 4, he was smoking a cigar and expressed himself as very well. Soon afterwards he had a little pain in the region of the gall-bladder, and on June 9 he had a free hæmorrhage, as shown by melæna, after which he made a good recovery and remained well.

A report from Dr. Hall in November, 1903, says that he is is good health.

The subject of peptic ulcer is one of great interest, that may be further elucidated by experimental work and by accurate clinical and pathological investigation, and my excuse for bringing forward only one case must be that the disease is fortunately uncommon, this being, I believe, the first that has been reported in this country.

THE TREATMENT OF POSTOPERATIVE VOMITING BY GASTRIC LAVAGE.[1]

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It is not an exaggeration to say that persistent postoperative vomiting is one of the most dangerous complications with which the surgeon and patient have to contend, yet this is a subject which has received scant notice at the hands of authors. This can be partially understood when we recollect that it has been only during very recent years that emesis after anæsthesia has been accounted for by strictly scientific and accurate methods. With many of us, vomiting associates itself in our minds with a group of such drugs as bismuth, oxalate of cerium, cocaine, etc., almost *ad infinitum*. The empirical method serves us well when the etiology of the condition is obscure, but with a well-defined cause the elimination or modification of that cause is the only rational and regular method of treatment, any other system of medicine should be classed as homœopathic or something just as bad. I shall show that the etiology of postoperative vomiting is due directly to the anæsthetic, absorbed and discharged into the stomach, and that gastric lavage will remove this irritating substance, thereby preventing nausea and vomiting.

The relative importance of this subject will appeal to any one constantly or occasionally in attendance upon surgical cases. Nausea in itself is a most depressing condition, mentally and physically, and, added to this, vomiting, especially after an abdominal operation, we have a condition which surpasses any other, so far as my knowledge goes, in point of dis-

[1] Read before the Clinical Society, Washington, D. C., April 11, 1904.

comfort. That it has a serious aspect is illustrated by two cases, briefly cited, which have come under my observation.

The first was a female, white, who had had both appendages removed. Vomiting began after the operation and continued, with few remissions, until four days later, at which time she died. The usual remedies were used and salt solution and olive oil subcutaneously with temporary benefit.

The second case was curettage after abortion. She was not considered an ill woman before this time. As she reacted, vomiting began, and continued almost without interruption until her death about six days later.

In both of these cases sepsis could be positively excluded.

While an interne at Columbia Hospital, two cases of ventral hernia occurred suddenly, after an attack of vomiting, and shortly after laparotomy had been performed. The practice at that time, as it is now, was to close abdominal wounds by sutures in tiers, and we shall never know how many buried sutures were broken by vomiting, and I firmly believe that the majority of ventral herniæ occurring in clean wounds are inheritances from postoperative vomiting. During regurgitation, blood-pressure is raised and the heart accelerated, both predisposing causes of secondary hæmorrhage. These are the more serious consequences, but we are witnesses to the fact that those patients who vomit excessively after regaining consciousness, frequently disarrange the dressing, do not remain quiet, require much more attention for the time being, make other patients nervous, and usually refuse a second operation should it become necessary.

The recent contributions of F. B. Turck (*Journal of the American Medical Association,* 1903, xl, pages 1206–16), to our knowledge of physiological surgery, have been so far in advance of any work along this line that I shall not hesitate to quote freely from him. His method was to tie the œsophagus of a dog, then administer the anæsthetic in the usual way. After using ether or chloroform an hour, he could detect the respective anæsthetic in the stomach contents, demonstrating

conclusively that it reached the stomach *via* the circulation, and was excreted by the cells of the gastric mucous membrane. He also dissected off the mucous membrane, distilled it, and invariably recovered ether or chloroform. This is not surprising, though generally unknown, and we have another illustration in morphia. This drug, used hypodermically, will appear in the stomach, and, if used in poisonous amounts, the stomach-tube plays an important part in the treatment.

Turck states that the prolonged use of chloroform or ether acts directly on the vasomotor centre and increases the pressure in the splanchnic areas with a fall of temperature. The toxins of chloroform and ether acting on cells disturb their metabolism and produce toxic bodies, which in turn cause auto-intoxication, associated with hemolytic and agglutinating bodies and precipitants.

There is lessened resistance of blood serum to normally excreted toxins and bacterial toxins, and to the growth of saprophytic and pathological organisms.

" That reflex effects result, such as reflex irritation set up by the excretion of the anæsthetic into the stomach and intestines.

" As the result of atony, there is the formation of toxins in the stomach and intestines through bacterial growth.

" Atony of the stomach and intestines results in accumulation of gases and interference with the circulation.

" There is increased toxicity of the stomach contents in the presence of chloroform and ether."

Summed up briefly, during anæsthesia there is a condition of atony of the stomach walls, together with an exudate of chloroform or ether into the stomach, acting as an irritant, and there is formed in their presence an increased amount of toxic substances.

I have autopsied several cases in which persistent vomiting was a feature, and in these cases found the stomach empty, the mucous membrane having a bluish-black, mottled appearance, and covered by tenacious mucus. The discoloration was due to capillary hæmorrhage.

The multiplicity of methods of treating postoperative vomiting warrants the assumption that no one method is specific, and a great many are useless. There are certain principles which many surgeons have adopted, and consist in having the gastro-intestinal tract empty before operation and keeping it at rest subsequently. To accomplish this no nourishment should be given within ten hours previous to the operation, and the bowels emptied by purgatives and enemata. Following the operation, nourishment or water should not be allowed for at least twelve hours, better twenty-four, and never to permit anything by mouth while nausea exists, as the smallest amount may produce a vomiting attack. During the past five years I have attended between two and three hundred postoperative cases, and cannot recall a single instance in which the vomiting ceased promptly and permanently after the exhibition of any drug, and always felt that the treatment by medication was more or less experimental. Each physician has a different remedy, and, as a rule, each remedy is usually worthless.

The only method which has given uniformly good results in my hands has been lavage of the stomach immediately after the anæsthetic is stopped and before the patient leaves the table.

With the etiology of vomiting known, the *rationale* of this plan is simple and logical, while its practical application is not beyond the resources of a senior student.

The stomach-tube required is one of the usual length, size, and moderately stiff, one eye in the extreme end, the second half an inch from the end, and the third an inch from the end, but opposite the second. No pump or bulb is necessary, and the rubber funnel usually attached should be replaced by one of glass. While the patient is thoroughly under the anæsthetic, a mouth-gag separates the jaws, the head resting upon the occiput. The tube is inserted well back against the pharynx and gently pushed down into the œsophagus until the end enters the stomach, usually indicated by a mark eighteen inches from the end of the tube. This varies but slightly. Occasionally we meet with resistance in the œsophagus (spasm),

and this is best overcome by steady, gentle pressure. Salt solution or sterile water is poured in the funnel, held about two feet above the patient, until a pint and a half or two pints are used, then the funnel is inverted close to a bucket upon the floor at the right of the table, at the same time the patient's head should be rotated strongly towards the right. The fluid usually flows freely, and when it ceases, the process should be repeated once or twice or until the fluid returns clear. In removing the tube from the mouth it should be pinched tightly until it is withdrawn, so the fluid it may contain does not flow back into the mouth. The washings usually contain considerable mucus and is frequently stained yellowish green, presumably by bile.

In no case have I failed to introduce the tube, and in not a single instance has a complication arisen during or after the lavage. This method has not abolished postoperative vomiting by any means, but it has lessened it to a very great extent. In a series of twenty consecutive cases, both male and female, ether used principally and of which sixteen were capital operations, I found 60 per cent. did not vomit. In 100 consecutive cases of ether anæsthesia without lavage, taken from records of Columbia Hospital, I found only 30 per cent. did not vomit. Several of my cases which did vomit are worthy of more than passing notice:

Case I.—Vomited one ounce shortly after operation. There was no further vomiting or nausea.

Case V.—A physician; appendicitis; before operation often had attacks of vomiting, keeping him in bed one or two days. He had such an attack after the operation. On the third day a dose of calomel caused vomiting.

Case XIII.—A nurse; ovaritis; appendicitis; nauseated forty-eight hours previous to operation; did not vomit until eight and one-half hours after operation, and then at the time she was given nourishment.

Case XVI.—Strangulated hernia; fæcal vomiting before operation; when stomach was washed out, a large quantity of dark fluid, with strong fæcal odor, was obtained. Vomited twice after operation.

Of the cases which did not vomit, three were taken to the operating room from the street, without previous preparation, and two of these patients had eaten a hearty meal a few hours previously.

Dr. E. C. Prentiss has kindly analyzed the fluid from the stomach in two cases:

CASE IV.—Quantity, one pint; reaction, neutral; odor, strongly of ether; sp. gr., 1000; sediment, very little, light, white, and flocculent. Free hydrochloric acid absent. Total acidity, zero. Albumen, none; peptone, none; dextrose, none; sugar, none. Microscopically, sediment consists of fat drops, squamous epithelium, and mucus.

CASE IX.—Quantity, one pint; reaction, acid; odor, ethereal; sp. gr., 1000; color, greenish; sediment, rather heavy, green; free hydrochloric acid, 3.3°; total acidity, 3.3°; dextrose, none; sugar, none; albumen, none; peptone, none; bile, trace.

It is essential that the patient should be well under the anæsthetic at the time the tube is inserted. If partial reaction has occurred, there may be some difficulty in passing the tube, as the patient makes efforts to regurgitate and clamps the tube between the teeth. Should the fluid not return at once, the tube may be withdrawn an inch or two and again replaced, and slight pressure made over the epigastrium. If there is then no return, remove the tube, flush it out, see that water flows through the tube, and introduce it again. It is never necessary to oil the tube, and grease injures the rubber. Should the tube become soft and pliable, which will probably occur in four to six months, it is to be discarded; therefore care must be exercised to purchase a fairly stiff one, of good quality red rubber.

We have been using gastric lavage at the Emergency Hospital since September, 1903, and, instead of becoming sceptical of its efficiency, our confidence has increased as we become familiar with its workings. While I have kept accurate data of only the first twenty cases, the subsequent ones have been just as satisfactory.

There are three conditions in which this prophylactic treatment is indicated:

1. In cases where there has been insufficient time to prepare the patient. Such patients often have their stomach distended with food.

2. In cases where the anæsthetic lasts an hour or longer. Operations of short duration are usually not followed by vomiting.

3. In cases where the patient previous to operation has suffered with attacks of nausea and vomiting or chronic gastritis.

It is contraindicated in operations upon the stomach and in very young children.

In those cases in which vomiting occurs in spite of lavage, absolute rest of the stomach brings the best results. Keeping the patient quiet by very small doses of morphia or heroin hypodermically, and withholding food and water twenty-four or even forty-eight hours, usually suffices. The intense thirst can be relieved by enemata of salt solution and nutrition maintained by rectal alimentation, but this is not required except in extreme cases. If the vomiting does not subside with such measures wash out the stomach with boric-acid solution. This is the most satisfactory method, and usually is sufficient to cure the most obstinate case.

PRIMARY SPASM AND HYPERTROPHY OF THE PYLORIC SPHINCTER, AND RESULTANT ENORMOUS DILATATION OF THE STOMACH.

RELIEF BY PYLOROPLASTY AND GASTROPLICATION.

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B. M., domestic, aged eighteen years, was brought to me by her mistress with a history of gastric disturbance of two years' standing, gradually increasing in severity until vomiting occurred after ingestion of any and all kinds of nourishment. No hæmorrhage, nor local or general pain. Normal weight, 140 pounds; at time of examination, eighty pounds. Bowels obstinately constipated, the only fæcal matter passed is a few hard pellets.

A perfect picture of starvation. Nothing abnormal detected by palpation. A stomach-tube passed to the level of the pubes. In the prone position the tube could be readily manipulated through the thin and relaxed abdominal walls, and an ineffectual attempt was made to pass it into the pylorus. The stomach, distended with CO_2, practically filled the entire anterior aspect of the abdomen. A diagnosis of pyloric stenosis, probably due to a cicatrized ulcer, was made; pyloroplasty and gastroplication advised and accepted.

Operation.—Immanuel Hospital, Omaha, Nebraska, January 22, 1896. Median incision between sternal cartilage and umbilicus. Inspection and palpation failed to show any sign of inflammatory thickening or narrowing of the pyloric lumen. Invaginating the pyloric end of the stomach and passing the finger towards the pylorus, a diaphragm obstructing the pylorus was encountered. Under considerable pressure a central opening yielded, and allowed the tip of the finger to pass into the pylorus, giving a sense of powerful muscular constriction.

It was decided to do a pyloroplasty after the method of Heineke. An incision was made into the pylorus on its anterior

aspect, a probe-pointed bistoury passed through the central opening of the pyloric valve, cutting outward. The incisions were prolonged into pylorus and stomach about four centimetres.

In the folds of the pyloric valve was a retracted bundle of muscular fibres about six millimetres in diameter. Close inspection failed to reveal any evidence of former ulceration in the pylorus or part of stomach open to inspection. The pyloroplasty was then completed in the usual manner.

It was the intention to do the gastroplication at the same time, but the low condition of the patient would not permit further operative measures. She made a prompt and uneventful recovery, and under careful diet gained strength and flesh rapidly, vomiting only a few times during her stay in the hospital. At the end of four weeks she returned to domestic service. Soon her old chain of symptoms returned, and she insisted on a second operation, although her weight remained at about 100 pounds.

Gastroplication, Immanuel Hospital, September 26, 1896, in the usual manner, except that, instead of passing the sutures parallel to the greater curvature, they were passed perpendicular, including several sections of the large portion of invaginated stomach wall.

Recovery uneventful. She was able to resume work, and in a short time weighed 130 pounds. She was addicted to dietary indiscretions, and had frequent attacks of vomiting during the following year and a half, but retained flesh and strength. Taking into consideration the enormously dilated stomach and its resulting motor inefficiency, this is scarcely a matter of surprise.

In a letter dated January 18, 1904, she states that her stomach for over five years has performed its functions in a normal and satisfactory manner.

Reviewing the case, the first point of interest is the extreme degree of dilatation of the stomach.

In view of the subsequent history of frequent attacks of vomiting, perhaps largely due to indiscretions in diet, but essentially due to motor inefficiency of the stomach, and in the light of more recent work in this field, gastro-enterostomy being frequently done for the relief of dilatation of the stomach of a degree still remaining in this case after the gastroplication,

it would appear as if it would have been good surgery to have done a gastro-enterostomy to facilitate drainage in addition to the gastroplication, and thereby perhaps shortened the period required for the stomach to regain its motor efficiency.

The second point of interest is the pathology. Primary hypertrophy and spasm of the pyloric sphincter is a rather rare condition, probably due to the obscure motor neurosis,, but important from a diagnostic stand-point, especially in ceases of young adults. Even if the diagnosis is not made until the abdomen has been opened, the operative procedure can be much simplified, and the pyloric obstruction effectually relieved through a small incision into the pyloric end of the stomach, blunt hooks passed through the contracted opening of the valve, and the muscle cut in one, two, or more places; even the mucosa could be sutured and the incision in the stomach closed in the ordinary manner.

CONGENITAL AND INFANTILE OMENTOCELE ON SAME SIDE, SEPARATED FROM GREATER OMENTUM AND PERITONEAL CAVITY.[1]

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AND

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In 1901, when operating on a case of left inguinal hernia, an anatomical diagnosis of "fatty hernia" was given for the reasons to be explained later on. Unfortunately, a complete history of the case has been lost, but the few points of interest in connection with it are briefly these: A swelling in the left inguinal region was first noticed when the patient was three years of age. At the time of the operation he was fifty-four years old. It had grown gradually for about thirty-five years, when it attained the size of an adult head, and remained about that dimension up to the time he consulted me. Occasionally he had symptoms of strangulation, which, however, disappeared in a short time. At intervals he had worn a truss, but for many years had not used one. The swelling was diagnosed by many surgeons here and abroad as hernia, and an operation for the radical cure recommended; but, owing to the total absence of any untoward symptoms at the time an operation was advised, consent was not given.

When the patient was seen for the first time in May, 1901, the mass was irreducible. There were symptoms of strangulation present, such as pain, tenderness, vomiting, and inability to have a bowel movement. These were relieved with little difficulty by elevating the hips and applying ice-bags to the swelling.

The operation was performed several months later under

[1] Read before the Chicago Surgical Society, March 7, 1904.

local cocaine anæsthesia, owing to a valvular lesion of the heart, and an atheromatous condition of the arteries.

To understand the hernial relations better, a few points in the operation will be briefly described. After the aponeurosis of the external oblique was incised and the canal exposed, the mass which extended into the scrotum was lifted out. It was doughy in consistency and irreducible, and together with its sac was easily isolated from the surrounding structures. The sac was then opened, and the greater portion of the large fatty mass, which was not adherent, was easily lifted out, and the smaller portion of the same fatty mass, which was fairly adherent to a small area of the sac, ligated and severed. The interior of the sac was shiny, and its upper proximal end was found to have no communication with the peritoneal cavity. After carefully dissecting the sac up to its abdominal pole, a pouch of peritoneum was dragged with it, although the sac with its contents was isolated and removed without opening the peritoneal cavity. This pouch of peritoneum which was dragged down by the mass, after the latter was removed, was pulled forward like any hernial sac and opened. No adhesions were found, and the surplus peritoneum removed. The edges were brought together with a running catgut suture. The rest of the technique, with the exception of transplanting the cord, was similar to a Bassini operation. The patient's recovery was uneventful.

The fact that the mass including the sac had no connection with the peritoneal cavity,—in other words, was extraperitoneal,—explains the faulty anatomical diagnosis.

The specimen is one of congenital and infantile omentocele, with portions of true and false vaginal processes in evidence. It presents the most dependent part of the great omentum with its cavity unobliterated. The hernial mass is nourished from the vessels of the spermatic cord. The testicle is flattened from pressure. The congenital hernia was not adherent, but the infantile hernia had sustained extensive peritoneal losses.

The occurrence of both congenital and infantile herniæ on the same side in one patient is anatomically possible by non-obliteration of the true processus vaginalis after descent of the testicle, and by the presence of a false processus vaginalis.

The omental nature of each hernia is plainly attributable

to the known, rapid, characteristic growth of the omentum in fœtal life, in all the higher vertebrates in general, and in man in particular. With the increasing development of the stomach and transverse colon, after rotation of the alimentary canal, the great omentum undergoes important changes, among which are shortening, increased vascularization, peritoneal concrescence, and fatty accumulation. The anatomical probabilities in congenital and infantile hernia, therefore, lead us to believe that the inception of these herniæ is to be sought during the anterotatory or U-loop period of the embryonal gut,—a time when the great omentum enjoys its greatest relative length, its relatively most abundant blood supply, and a special relation to the inguinal region where the abdominal walls afford minimal resistance, and when the gubernaculum is reducing the testicle to the scrotal cavity.

The two herniæ traced cephalad end in a common omental mass. The omentocele resident in the false tunica vaginalis, and smaller than the congenital omentocele, had undergone such extensive peritoneal losses that its removal during the operation was, beyond doubt, a matter of most delicate and difficult dissection. The hernia in the true processus vaginalis had in all these years of its continuance sustained no peritoneal loss; and this fact should elicit the inquiry: Do infantile and congenital omentoceles in general deport themselves in this manner?

The omental hernial mass derived its blood supply from the vessels of the spermatic cord, a circumstance which, in view of the complete separation of the omentocele from the intra-abdominal omentum, is significant evidence of the extreme chronicity of the case. Two interesting physiological processes must have occurred simultaneously in this specimen: (*a*) the gradual loss of nourishment through the omental arteries; (*b*) the gradual establishment of an entirely new circulation.

The omentocele, as a whole, may be compared to a glove with two imperforate fingers; the two fingers occupied the two vaginal processes of the peritoneum. The part of the

omentocele represented by the body of the two-fingered glove in the simile consisted of the anterior and the posterior lamellæ of the great omentum. The finger-like processes must have entered the peritoneal diverticula at a very early date, and the entire omental mass must have been detached from the parent omentum, prior to the deposition of any considerable quantity of fat.

The hernial mass down to the bifurcation contained the most dependent part of the cavity of the great omentum of fœtal life. In other words, the relations and conditions of the omental lamellæ were primitive. This feature will be more fully appreciated when it is remembered that in the great majority of adult instances the cavity of the great omentum becomes obliterated in its subgastric parts. Macroscopically, the hernial mass is clearly omentum, which, as is well understood, differs structurally from all other peritoneal derivatives.

The complete expatriation of the omentocele from the abdominal cavity, with entire separation from the parent great omentum, renders this case, so far as we are informed, quite unique. Reduced to the vernacular of ordinary herniology, the expatriation process must have been one of slow strangulation. As previously stated, it must have begun prior to the deposition of omental fat, for extravagant, indeed, were a speculation attributing to the peritoneum in the vicinity of the internal abdominal ring an ability to pinch off this enormous mass of omentum. Two embryologic principles must be in vogue to harmonize the macroscopic findings in this case with known developmental laws, viz., (1) the preservation of the fœtal type of great omentum extra-abdominally built up; (2) the tendency of evaginated or diverticular structures in general to become physiologically or pathologically separated from their anatomical antecedents.

The type of the embryonal great omentum prior to rotation of the alimentary canal will be recalled as a reduplication of the two layers of the posterior mesogaster, making an apron of four layers of peritoneum. The two ventral layers form the anterior lamella of the great omentum, while the two dorsal

ones form its posterior lamella. The two ventral layers fuse early with each other; likewise the two dorsal layers undergo early fusion by concrescence of their epithelial cells. The space between the lamellæ is the cavity of the great omentum, and is usually obliterated in infancy. Assuming an early invasion of the non-obliterated vaginal processes by the most dependent part of the great omentum, is its subsequent development according to its foreordained type more remarkable than a tumor of hair in the stomach, and more incomprehensible than an ectopic gestation?

Strangulation, whether acute or chronic, belongs to the embryological class of expatriated structures governed by known laws, and herein, in extreme cases like the one presented, are we to seek our anatomical latitude and longitude. The inherent tendency of diverticular products is (1) to partake of the nature of the part from which they are derived; (2) to become smaller and smaller. The foramen of Winslow, marking the original evagination route of the cavity of the great omentum, is large in the child, but relatively small, or even entirely obliterated, in the adult. The thyroglossal duct tends to early closure, thus expatriating the thyroid body from its oral antecedent. Closure of the craniopharyngeal canal separates the brain from the pharynx. Obliteration of the proximal end of the processus vaginalis shuts off the tunica vaginalis from the peritoneal cavity. The frontal and maxillary sinuses may be temporarily or permanently shut off from the nose. Stenosis of the Eustachian tube may occur, separating the middle ear from the nasopharynx. Numerous cases might be cited confirmatory of the previous statement, that diverticular cavities possess an inherent tendency to close. The great omentum in our specimen occupied two diverticula, and as an extreme possibility, yet in harmony with a universal law, became expatriated. The principle involved is the same as that underlying evaginated structures in general.

As further clinical evidence, confirmatory of the tendency of evaginations to complete expatriation, two specimens from the private collection of Dr. Joseph Fairhall will be described.

In these the omentocele is completely encapsulated, while the peritoneal sac had developed an imperfect partition. These interesting specimens are described below by the operator:

"The history of them as taken from my note-book is as follows: Specimens 50 and 51 are both from the same patient, result of an operation performed at Lake View Hospital, Danville, Illinois, August 10, 1901, by Drs. W. A. Cochran and Joseph Fairhall. Female, married, multipara, aged thirty-eight, weight about 200 pounds, much adipose tissue. Operation, 'Umbilical Hernia.' Umbilicus being removed, a large lump was found attached posteriorly, examination of which showed it to be a sac or pocket of fat. Specimen No. 50 shows the umbilicus with sac removed, showing the fat. No. 51 is the sac which had contained the escaped intestine; close observation will reveal a septum, which divided the sac into two pockets, each containing a fold of intestine. The operation was a successful one, the patient making a rapid recovery, although the closing of the wound was difficult, owing to the amount of adipose tissue encountered."

The anatomical factors concerned in congenital and infantile hernia, like those concerned in acquired inguinal hernias in general, are so intimately associated embryologically with the descent of the testicle and the development and disappearance of the primitive kidney, that a brief reference to this early period and its mesodermic metamorphoses seems eminently practical.

At an early date in the embryo, the indifferent sexual glands, the Muellerian ducts, and the primitive kidney occupy a position behind the dorsal peritoneum in a mesodermic bed, much like the adult kidney, and its ureter are surrounded by their fatty protective. This fibroperitoneal investment for the trio just named extends from diaphragm to bottom of scrotum. The sexual glands develop testicles or ovaries, according to sex, and these subsequently migrate to scrotum and pelvis respectively; the Muellerian ducts, destined to become uterus, vagina, and oviducts, are held in functional abeyance until puberty; the primitive kidney functionates from the start, ex-

ceeds the other two members of the trio in size, a circumstance directly responsible for a figure of speech, by which the common investing peritoneum is called the *ligament of the primitive kidney*. The testicle is bound to the diaphragm above, to the peritoneum in front and laterally, and to the bottom of the scrotum by this self-same ligament of the primitive kidney. For purposes of convenience of description, this ligament has received the following local names: (*a*) The part in immediate contact with the testicle is called the *mesorchium;* (*b*) the part extending from the upper pole of the testicle to the diaphragm is called the *diaphragmatic ligament* of the primitive kidney; (*c*) the part extending from the lower pole of the testicle to the bottom of the scrotum is called the *inguinal ligament* of the primitive kidney.

Interesting metamorphoses looking to the formation of the inguinal canal and the descent of the testicle are now at hand. The primitive kidney disappears, and with its loss the diaphragmatic ligament becomes atrophic; hence the testicle is no longer bound to the diaphragm; the mesorchial attachments give way; hence the testicle is no longer bound to the deep surface of the peritoneum; muscular fibres develop in the inguinal ligament, completing the gubernaculum, and the testicle awaits its passive migration to the scrotum through gubernacular traction.

The gubernaculum is the inguinal ligament plus unstriped muscular fibres. Superiorly, it divides into two branches, one of which is inserted into the lower pole of the testicle, the other into the deep surface of the peritoneum. Inferiorly, the gubernaculum has three attachments,—(*a*) one to the abdominal wall, which draws the testicle to the internal ring; (*b*) a second to the pubic bone, which draws the testicle through the inguinal canal; (*c*) a third to the bottom of the scrotum, which lands the testicle in the scrotum. The testicular and peritoneal insertions of the gubernacular act quite independently of, and not simultaneously with, each other, for the processus vaginalis is preformed for the subsequent accommodation of the testicle. On this point, Bevan aptly says:

"The idea so prevalent among medical men, that the testicle drags down a process of peritoneum in its descent, is an error. I have found in all my cases, even when the testicle is well within the abdomen, a large sac of peritoneum passing through the canal, occupying the space in front of the external ring and passing down towards or into the scrotum. Long before the testicle descends, the vaginal process of peritoneum has preceded it, lying in front of the gubernaculum testis, and reaching into the scrotum." (Section on Surgery and Anatomy, American Medical Association, 1903.)

Summed up, the normal migratory phenomena of the testicle are as follows: (1) The testicle, a product of the asexual gland, is firmly attached to the peritoneum and diaphragm by the mesorchium and diaphragmatic ligament, respectively; (2) atrophic changes in the primitive mesorchium and diaphragmatic ligament, following disappearance of the primitive kidney, liberate the testicle, and make its subsequent migration, through gubernacular traction, possible; (3) muscular fibres develop in the inguinal ligament, thus completing the gubernaculum, which has both superior and inferior attachments; (4) the peritoneal gubernaculum reduces the processus vaginalis, while long afterwards the testicular gubernaculum reduces the testicle to the scrotum, and thus, by union of testicle and processus vaginalis, the permanent mesorchium and tunica vaginalis testis are formed; (5) that part of the processus vaginalis between the internal ring and the upper pole of the testicle suffers obliteration.

The following departures from normal migration of the testicle may occur: (1) The testicle may remain in its primitive position, firmly bound to diaphragm and peritoneum by the diaphragmatic ligament and the primitive mesorchium, respectively; (2) the testicle may migrate towards the diaphragm, a circumstance due to a reversed gubernaculum, due to development of muscular fibres in the diaphragmatic ligament instead of in the inguinal ligament; (3) migration of the testicle towards the scrotum may become arrested at any point of its course: (4) there may be two vaginal processes,

true and false, reduced by the peritoneal gubernaculum, favoring both congenital and infantile hernia.

There are three varieties of congenital hernia dependent on the type of unobliteration of the true vaginal process: (1) The pouch of peritoneum remains entirely patulous, permitting contact of hernia with the visceral peritoneum of tunica vaginalis testis. (2) The pouch of peritoneum remains patulous down to a point near the upper pole of the testicle, permitting the so-called hernia into the funicular process. (3) The pouch of peritoneum is closed at the internal abdominal ring by a septum, which, forced down into the pouch by a protruding hernia, forms the encysted variety of congenital hernia. (4) Either of the above varieties may be complicated by an infantile hernia, of which latter, as will appear later, there are four varieties.

On the other hand, an infantile hernia is concerned with an unobliterated true processus vaginalis, and also with a false processus vaginalis. Consequently, there are four varieties of infantile hernia, determined by the *particular degree of unobliteration* of the true vaginal process, into relation with which the infantile hernia is brought. These four varieties are as follows:

1. In the first variety, the infantile hernia in the false vaginal process lies behind the true vaginal process, in which obliteration has occurred at the internal abdominal ring only. In this, three layers of peritoneum are between the operator and the hernia, two belonging to the true and one to the false vaginal process.

2. In the second variety, the infantile hernia, in the false vaginal process, lies behind the true vaginal process, in which obliteration has occurred at the internal ring and also at the level of the upper pole of the testicle. In this, three layers of peritoneum intervene between the operator and the hernia,—two belonging to the true and one to the false vaginal process.

3. In the third variety, the infantile hernia in the false vaginal process lies behind the true vaginal process, in which no obliteration has occurred. In this, three layers of peri-

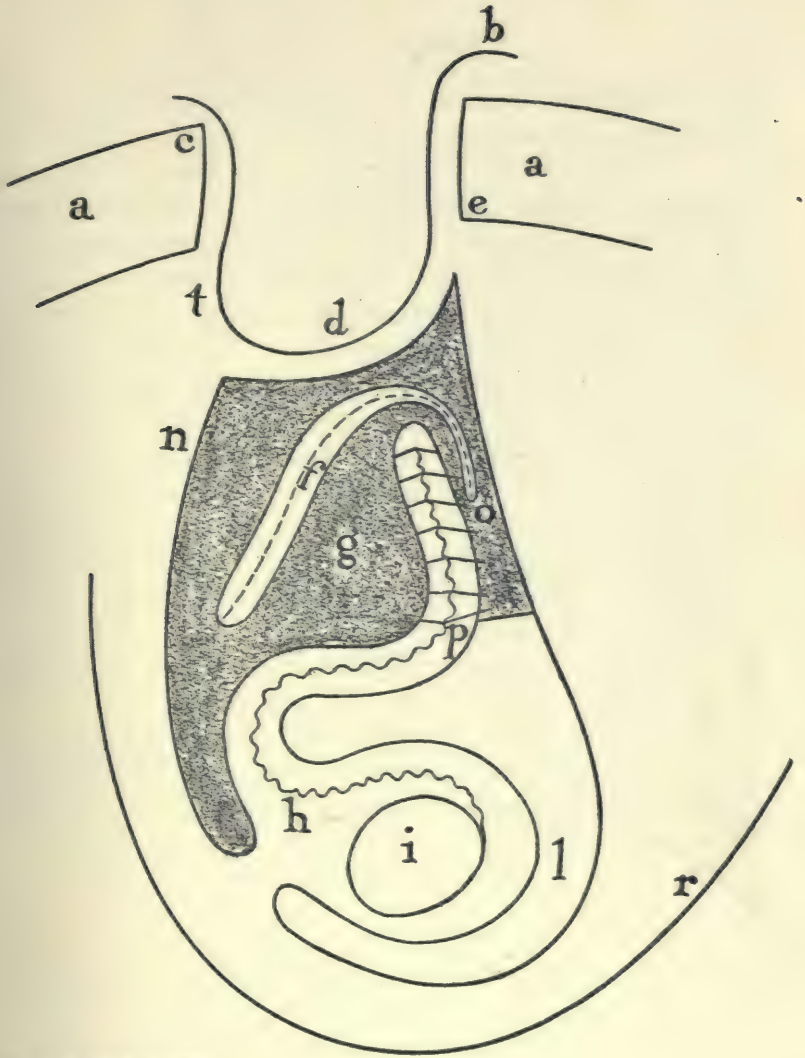


FIG. 1.—*d*. Inguinal canal.
c. Internal ring.
e. External ring.
a. Abdominal wall.
b. Parietal peritoneum.
f. Unobliterated cavity of omentum.
n. Infantile sac situated behind tunica vaginalis below pouch of peritoneum, which it drags with it from above (the testicle lies in the scrotum), and contains omentum. Has no connection with peritoneal cavity.
g. Larger part of omentum; looks like bunch of fat.
t. Second hernial pouch above the scrotal infantile and funicular hernia.
o. Funicular portion of the tunica vaginalis containing part of omentum that receives blood supply from spermatic vessel.
p. Branch of spermatic vessel supplying blood to omentum.
h. Spermatic cord.
l. Tunica vaginalis.
r. Scrotum.
i. Testicle.

toneum intervene between the operator and the hernia,—two belonging to the true and one to the false vaginal process.

4. In the fourth variety, the infantile hernia in the false vaginal process lies behind the true vaginal process, in which obliteration had occurred at the level of the upper pole of the testicle only. In this, as in the preceding cases, three layers of peritoneum intervene between the operator and the hernia, —two belonging to the true and one to the false vaginal process. This fourth variety of infantile hernia, rendered very complex by an enormous congenital omentocele, is the kind presented, of which the following deserves consideration:

(1) The unobliterated cavity in the lowest part of the great omentum, forming the infantile hernia. (The dotted line (Fig. 1) indicates the passage seen in the specimen.)

(2) The great destruction of epithelium in the congenital hernia is indicated by dots in the drawing.

(3) A very large peritoneal sac containing an infantile hernia freely movable.

(4) A large hernial mass occupying the upper part of the original tunica vaginalis testis, everywhere adherent, even involving the spermatic cord and deriving blood supply therefrom.

UNSUSPECTED LESIONS IN MOVABLE KIDNEYS DISCOVERED DURING NEPHROPEXY.

BY FRANK E. TAYLOR, M.B., F.R.C.S.,

OF LONDON,

Pathologist to Chelsea Hospital for Women.

THE cases here related are, I think, worthy of being placed on record because they show that a movable kidney may be the seat of an entirely unsuspected renal lesion. Moreover, three of them occurred during the writer's tenure of the office of Resident Medical Officer at Chelsea Hospital for Women, London, in the year 1901. During that year the operation of nephropexy or nephrorrhaphy for movable kidney was performed eleven times; and since then there have been nineteen more, making a total of thirty nephropexies in three years. In none of the subsequent cases, however, has an unsuspected renal lesion been discovered in a movable kidney as revealed by the performance of nephropexy. This condition was thus found to exist in three out of thirty cases, or exactly 10 per cent.

CASE I.—*Movable Kidney with unsuspected Renal Calculus; Nephrolithotomy and Nephropexy.*

A. D., a single woman, aged thirty-two years, was admitted into Chelsea Hospital for Women under the care of Dr. A. E. Giles, on December 2, 1901, complaining of dragging pain in the right side, of eight months' duration. The pain was felt both in the front of the abdomen and in the bottom of the back. It had never been felt to shoot into the thigh or labium, and was of a dragging and not of a shooting character. It was, however, exaggerated by exertion and relieved by rest. The pain was also worse at the menstrual periods, which were regular and otherwise normal. The urine had never contained any blood, and on examination was found to be free from albumen and blood. There

was neither difficulty, pain, nor frequency of micturition, nor had any of these symptoms at any time existed.

On abdominal examination the right kidney was found to be freely movable, otherwise *nil.* Marked lateral curvature of the spine to the left was also noted. On December 16, Dr. Giles exposed the kidney in the loin under ether, and found that in addition to being freely movable it contained a small calculus, which was cut down on and removed. The calculus was of the "coral" variety. The incision in the kidney was sewn up and the kidney was fixed as high as possible by means of two silkworm-gut sutures. The wound was sewn up in two layers and a drainage tube inserted. The tube was removed on the 18th and the stitches on the 23d. The wound rapidly closed; the patient made a complete and rapid recovery, and was discharged from hospital on January 2, 1902.

CASE II.—*Movable Kidney with unsuspected Renal Calculus; Nephrolithotomy and Nephropexy.*

This case is an almost exact repetition of the last. It occurred in the private practice of Mr. F. F. Burghard, who has very kindly supplied me with the notes of the case to incorporate into this paper.

Jane R., aged thirty-four years, was operated upon on July 30, 1901, for movable right kidney. The only symptoms complained of were severe dragging pain in the back and very troublesome frequency of micturition. No other symptoms of stone had ever been observed. The right kidney was very movable, passing right down into the pelvis. When the organ was grasped between the hands the patient felt sick, but there was no real tenderness.

At the operation a small, hard nodule was felt on the posterior surface of the kidney just external to the pelvis near the upper pole. It was detected when the kidney was brought out upon the loin and grasped between the finger and thumb. A pair of sinus forceps pushed into it detected a stone, which was accordingly removed. It was the size of a small Barcelona nut and was of uric acid.

The kidney was decorticated on the posterior surface and nephropexy performed. No drainage tube was used. The patient made an excellent recovery.

CASE III.—*Movable Kidney with unsuspected Localized Primary Renal Tuberculosis; Partial Nephrectomy and Nephropexy.*

H. C., a married woman, aged twenty-five years, was admitted into Chelsea Hospital for Women under the care of Mr. Bland-Sutton on May 23, 1901, on account of a movable right kidney and a left inguinal hernia. She had had two children and one miscarriage, the last confinement being a year and a half before admission. She had noticed pain of a dragging nature in the right renal region for about six months. This was worse when she walked about. The inguinal hernia, which had been present for many years, had been gradually increasing in size during the past four years. There had never been any disturbance of micturition and menstruation was normal. The urine was acid in reaction, with a specific gravity of 1020, and contained neither albumen nor sugar. It was not examined for tubercle bacilli.

On abdominal examination the kidney was readily felt to be freely movable in the right hypochondrium, and the hernia, which was a left inguinal one, was about the size of a walnut and easily reducible. Ether was administered by Mr. Keith on May 27, 1901, and Mr. Bland-Sutton exposed the right kidney by a lumbar incision. It was found to be freely movable, and on separating it from the surrounding fat and bringing it on to the surface for more careful examination (which is part of the usual routine practice in the performance of nephropexy in this hospital), a dense, depressed scar was observed running across the kidney at the junction of its lower fourth with its upper three-fourths. This was incised and curdy pus exuded, revealing the presence of an old tuberculous cavity. The remainder of the kidney seemed to be quite healthy. The lower pole of the kidney containing the whole of the tuberculous deposit was accordingly excised. Iodoform was freely rubbed into the cut surfaces, and these were then drawn together by a mattress suture of fine silk, the capsule being then sewn up with a continuous fine silk suture.

The remnant of the kidney was then fixed to the posterior abdominal wall, as high as possible, with one silkworm-gut suture. A drainage tube was inserted into the wound, which was stitched up with deep interrupted silkworm-gut sutures, and an aseptic dressing applied.

Attention was now turned to the left inguinal hernia. An incision two inches long was made over the left inguinal canal, and the hernial sac was exposed, separated, opened, explored, ligatured with fine silk, and cut away. The canal was then obliterated by

means of these buried interrupted silkworm-gut sutures, and the skin incision united with a continuous silk suture.

May 29. The temperature rose last night to 100.2° F. The first three specimens of urine passed after operation were deeply blood-stained. The dressings were changed; there was very little discharge on them.

May 30. The temperature last night rose to 101° F., but has now fallen to 99.4° F. Patient has passed twenty-two ounces of urine in the last twenty-four hours. Complains of some pain in the right side. On dressing the wound, no discharge was found on the dressings; the tube was withdrawn, and a shorter one substituted.

June 1. Tube withdrawn. Temperature gradually falling.

June 3. Stitches removed from both wounds; complete primary union except for the track of the drainage tube in the lumbar wound. The temperature now reached the normal and remained so throughout.

Microscopic examination of the removed portion of kidney revealed the typical picture of tuberculosis, viz., and abundance of giant-cell systems, with tubercle bacilli present in the giant cells.

Recovery was rapid and uneventful, and the patient left the hospital well on June 20, 1901.

Case IV.—*Movable Kidney with unsuspected Hydronephrosis and Congenital Smallness of Ureter; Nephropexy.*

E. J., a married woman, aged forty years, was admitted into hospital under Mr. Bland-Sutton's care on October 10, 1901, complaining of dragging pain in the right side and in the bottom of the back of ten years' duration. She had had ten children and one miscarriage. The last confinement occurred eight months before admission into hospital, and patient says that a tumor of the kidney came down and obstructed the passage of the child. She had had the pain, however, long before this; almost continuously and sometimes very sharp. She had sometimes great difficulty in passing water, but blood had never been passed, and the urine had always been normal in appearance.

On abdominal examination marked tenderness was found in both hypochondriac regions, and a freely movable, but not obviously enlarged, kidney on the right side. On November 4, Mr. Bland-Sutton exposed the right kidney under ether. It was found to be very movable and somewhat flabby. The ureter was

extremely small, and the pelvis of the kidney was somewhat dilated. The kidney was sutured to the posterior abdominal parieties with three silkworm-gut sutures. The stitches were removed on November 11, and the wound had then completely united by primary union. Recovery was rapid and complete, and the patient returned home well on November 21, 1901.

CASE V.—*Movable Kidney; Unsuspected Renal Tuberculosis; Nephropexy abandoned to be replaced by Nephrectomy.*

I must thank Mr. Watson Cheyne for permission to publish this case, to which my attention was kindly drawn by Mr. F. F. Burghard. In it, too, the diagnosis before operation was simply that of movable kidney, and when operation was decided upon, it was not anticipated that anything more than nephropexy would be necessary. Owing, however, to the situation of the tuberculous foci which were discovered on exposing the kidney, nephropexy was abandoned and nephrectomy substituted.

S. B., a thin and pale married woman, aged thirty-nine years, was admitted into the Gynæcological department of King's College Hospital on February 19, 1901, complaining of frequency of micturition. Examination having shown the pelvic organs to be normal, the patient was transferred to the surgical ward under the care of Mr. Watson Cheyne.

The following history was obtained from her: Early in the previous summer (*i.e.*, 1900) she noticed that she was passing water more frequently than usual, although very little was passed at each act. The urine was somewhat lighter in color than usual, and it had never been noticed to contain blood. About a fortnight later the patient began to suffer from attacks of severe stabbing and aching pains in the right loin, which was then tender to the touch. These attacks usually lasted about an hour, and were very acute. The pain would shoot down from the loin to the pubic symphysis. The desire to micturate would suddenly arise, and then be imperative. In the earlier stages of the disease a sickening sensation was experienced on passing the urine, but this symptom had disappeared before admission into hospital. Throughout there has been continual retching, which was very severe during a bad attack of renal pain. The retching seemed to give some relief to the pain. The digestion and state of the bowels were good, but the patient had been losing flesh.

Abdominal Examination.—On inspection of the abdomen

nothing abnormal was noticed. On palpation the right side of the abdomen was found to be exceedingly tender, the slightest touch being sufficient to evoke considerable spasm of the muscles. On palpating the right loin the right kidney could easily be felt. It was so mobile that the edge of the hand could be pushed down between it and the lower margin of the ribs. Manipulating in this region caused the patient to have a most sickening sensation; a similar sensation being produced on pressing the loin, and this did not seem to be increased on handling the kidney. Percussion of the abdomen yielded a good tympanitic note, and the areas of splenic and hepatic dulness were normal.

Operation.—On March 6, 1901, the patient was anæsthetized by A. C. E. The patient was placed on her left side, and Mr. Watson Cheyne made an incision in the right loin from the outer border of the erector spinæ about one inch below the last rib downward towards the anterior superior iliac spine, thus exposing the kidney, which was freed from its surroundings and delivered through the lumbar incision. When thus exposed, some small miliary tubercles were found upon the surface of the outer border of the middle segment of the kidney. An incision was then made along its outer border. This revealed the presence of two small caseating tuberculous foci. The operation of nephropexy was therefore abandoned and the kidney was removed, the ureter being ligatured separately from the vessels in the pedicle. A drainage tube was inserted and the wound sewn up above and below, two loose stitches being inserted into the middle of the wound, to be tied on removal of the drainage tube.

There was some pain and a slight rise of temperature after operation, and the urine for a time contained a little albumen. On March 8 the drainage tube was removed and the two loose stitches tied. The patient was discharged on April 17, when the wound was not quite healed, there being a narrow, deep sinus still present. The patient was otherwise well and was passing the normal amount of urine.

The sinus persisted, and the discharge was so profuse that the patient was readmitted to hospital on March 17, 1902, and the sinus was opened and scraped, no suture being found. She was again discharged on May 3, 1902, when the sinus was still present, though much smaller than before.

From a consideration of these cases, it may be regarded as conclusively proved that a movable kidney is not uncommonly the seat of some lesion,—be it calculus, tuberculosis, hydronephrosis, or other lesion,—which is quite unsuspected from a clinical examination of the case. There undoubtedly exists in the minds of many surgeons much diffidence in undertaking the operative fixation of movable kidneys, arising probably from the lack of discrimination with which the cases have been previously submitted to operation either by themselves or others, and possibly in some cases from faults in the technique of the operation which have led to failure in the relief of the condition. One of these, and one which I think is too little recognized, is fixation of the kidney in some malposition, usually too low down. In properly selected cases, where the kidney is adequately fixed in a good position, that is to say, sufficiently high up, much relief is usually afforded by the operation of nephropexy.

If a patient suffers from a movable kidney which gives rise to definite symptoms, there is absolutely no reason why he or she should not be operated upon and obtain the relief to be derived from a well-performed nephropexy. This is especially the case should there be present any unusual or unexplained symptom, and still more so if any tenderness or enlargement of the kidney can be made out. The cases reported above constitute, then, a plea for the more frequent performance of nephropexy for movable kidney. In performing the operation, however, it is not sufficient merely to expose the kidney and stitch it to the handiest part of the loin in a more or less haphazard fashion, as is not infrequently the case. In every operation the kidney should always be carefully separated from its surroundings and brought to the surface of the loin,—a proceeding which in the case of a movable kidney is seldom attended with any difficulty, especially if the upper pole of the kidney be sufficiently cleared. Having brought the kidney outside the loin, it should be carefully examined both by inspection and palpation. Should the condition of the kidney appear doubtful at any spot, the renal parenchyma should be freely

incised to the necessary extent, otherwise lesions may be overlooked. It may be that such careful examination may reveal such extensive disease, or the presence of disease in such a position as to make hysteropexy impracticable, in which case nephrectomy may have to be substituted for it, as in Case IV of the present series. Such incisions into the renal parenchyma are easily relieved, any tendency to hæmorrhage being readily controlled by a series of well-placed sutures.

TRANSVERSE ECTOPY OF THE TESTIS.[1]

BY ALBERT ASHTON BERG, M.D.,

OF NEW YORK CITY,

Adjunct Surgeon to Mount Sinai Hospital.

M. F., thirteen years old, was admitted to Mount Sinai Hospital July 31, 1902. Since his birth he had a left-sided rupture, which was always reducible. On admission, physical examination showed the boy to have healthy internal organs. The right side of the scrotum was poorly developed. There was a large scrotal hernia on the left side. The hernial orifice was large, the epigastric vessels lay along its inner margin. At the bottom of the left half of the scrotum was a fair-sized testicle; its free concave border pointed downward. From its right pole a normal-sized cord passed upward to near the root of the penis, then curved sharply to the left, and was lost near the opening of the hernial ring. On slight coughing, a small mass, size of almond, presented at the left external ring. It could be pulled down into the scrotum. Pressure upon it gave testicular sensation. A cord passed from it into the hernial ring. The right external inguinal ring was very small. No cord could be felt to enter it. On violent coughing, several loops of intestines prolapse through the left inguinal canal, pushing the smaller testicle before them, but not affecting the position of the larger and stationary one.

On August 4, 1903, the writer found at operation for the radical cure of the hernia the following relation of the testicles and their cords. Both testicles and cords were intimately connected with the hernial sac on the left side. Both cords passed through the left inguinal canal. The testicles were of unequal size. The smaller occupied the upper part of the sac, and its cord had a distinct mesentery; it passed up into the left inguinal canal, through the internal ring, across the space of Retzius, to the right inguinal region, whence it descended to the pelvis. The larger testicle lay in the bottom of the sac; its cord passed up into the

[1] Presented at the Genito-Urinary Section of the New York Academy of Medicine, March 18, 1903.

left inguinal canal, and descended on the left side of the bladder to the pelvis. The right internal ring was exposed, palpated, and found closed. The scrotum showed no evidence of division into two compartments. Both testicles appearing normal, and there being no reason for transferring the right testicle into the right inguinal canal and right side of the scrotum, both cords and testicles were treated as one, and the radical cure of the hernia proceeded with by the House Surgeon, Dr. M. G. Seelig. The peritoneum forming the sac was divided transversely at the level of the internal ring, and the peritoneal cavity closed by catgut suture. The peritoneum forming the sac was then split in its entire length, and reflected around both cords and testicles, being, so to speak, turned inside out. Its edges were united behind the cords and testicles by four interrupted catgut sutures. This method of dealing with the sac of a congenital hernia, I have used for three years with perfect satisfaction. It saves time, avoids unnecessary dissection, and does away with the large raw surface of the cord which is left in the old method of dissecting off the sac from the cord. Radical cure according to Bassini completed the operation. Uneventful convalescence. Primary union in the wound. Six months later no return of the hernia. Both testicles movable and in the left scrotal pouch.

Lenhassek, quoted by Kocher and Quervain in the *Encyklopädie d. gesammten Chirurgie,* has described this type of ectopy of the testicle, and has called it " transverse ectopy of the testicle."

OSTEOMALACIA IN THE MALE.[1]

BY THOMAS A. DAVIS, M.D.,
OF CHICAGO,
Professor of Surgery in the College of Physicians and Surgeons,
AND
D. J. DAVIS, M.D.,
OF CHICAGO,
Fellow in Pathology in Rush Medical College.

(Clinical Report by Dr. T. A. Davis.)

The patient appeared in my clinic at the College of Physicians and Surgeons on November 24, 1902, when the following history was elicited:

S. J., aged thirty-three years; of Norwegian nativity; has resided in this country for twenty-five years; has been married thirteen years, and is the father of three healthy children. His occupation has been that of wood-scroll sawyer in a piano factory. His mother died at the age of fifty-seven, of cancer of the stomach. Father alive; has diabetes. One brother and four sisters alive and well. Four brothers and sisters died in early childhood. One sister is a hunchback.

The patient is a scroll sawyer in a piano factory. His habits are good. Has had the diseases of childhood. Had typhoid at sixteen years of age. Two years ago patient was treated for rheumatism in the feet and ankles. A year ago he suffered some from pains in the upper extremities. There was no swelling of the extremities at that time. There was no pain at night nor when the patient was inactive in the daytime. He felt weak and did his work with difficulty, being exhausted before the end of each day. Pain was present only when patient was at work. Can get no history of there having been any more pain in the arm which is now injured than in other limbs. He has not been laid up from work until the present trouble—fracture—occurred about three months ago.

Additions to history obtained at later date after diagnosis had been made. *Previous History.*—The patient lived in Norway until about nine years of age (near Christiana). His father was a

[1] Read before the Chicago Surgical Society, March 7, 1904.

gardener and lived three miles from town, among healthy surroundings. Came to America, and first located at Mendota, Illinois, where he attended school for one and a half years; then moved to Chicago, Grand and Centre Avenues. Attended school six months; moved then to Pullman, where he attended school for one year, and then went to work in Pullman car factory, machine department, for one year. Work was light. He then moved to Iowa with his parents, where he worked on the farm in the summer and attended school in the winter, for one year. He then moved back to Chicago and began work in the Cable Piano Factory, working at cabinet work, for about a year, and then changed to scroll-sawing, which he has followed for the past twelve years, up to the time of his injury. Always lived among healthy surroundings. No nervous disease on either side of family.

Present Illness.—Eleven weeks ago patient slipped and fell in soft mud while crossing a ditch. In falling he thinks he twisted the left arm, but does not know exactly how. The arm became swollen immediately, and was painful from the shoulder down to the elbow, especially about the middle, which showed a large ecchymotic area. This region was painful to palpation and on motion of either shoulder or elbow. A few hours after the injury the patient was taken to a physician, who strapped the arm to the thorax with adhesive plaster, immobilizing both shoulder and elbow. This treatment was followed for five weeks and then a plaster cast was put on. During the period in which the limb was bound by adhesive strips, the suffering was quite severe. The pains became much relieved by the plaster cast, which was worn for a period of six weeks. The swelling also disappeared during this time.

On November 10, 1902, eleven weeks after the injury, the patient was seen in my clinic at the College of Physicians and Surgeons, in my absence from the city, by my colleague, Dr. Bayard Holmes. A diagnosis of ununited simple fracture of the junction of the lower and middle thirds of the humerus was made and under general anæsthesia the treatment for delayed union—that of attrition of fractured surfaces—was rendered, and a plaster-of-Paris dressing applied.

Two weeks later the patient was seen by me for the first time at my clinic; the plaster cast was removed. An examination of the limb showed the usual amount of atrophy from disuse, and

a flail-like joint at the point of fracture. There was no apparent thickening of the soft structures or of the bone, so that, in the absence of any regenerative evidence, the condition of pseudo-arthrosis was considered, and under that diagnosis I proceeded to operate.

Exploration of Fracture.—Esmarch's constrictor was applied and an incision made along the outer anterior surface of the arm. Careful dissection was made to avoid injury to the musculo-spiral nerve and its accompanying vessels These structures were separated from the surroundings for a short distance for demonstration. The periosteum was found bulging to a slightly increased diameter than that of the normal bone, and on incising it its blood-like contents spurted over the assistants, who were three feet away.

The incision was enlarged to the full length of the sac, which was wiped out with gauze sponges, exhibiting a uniformly smooth and almost glistening white surface. There were two or three scales or spicules of calcareous matter attached to the sac, but no other tissue. The quite extensive rarefaction of bone was at once apparent; the walls of the lower fragment were so attenuated that they offered but slight resistance to digital pressure, feeling like parchment being crumpled by the fingers. The enlarged medullary cavity was filled with material of new blood-clot consistency. The walls of the upper fragment were not so attenuated and the medullary cavity not so large. The contents seemed the same as those of the lower fragment.

Pathological Fracture.—The diagnosis of pathological fracture was made, and portions of the periosteal sac, the bone, and medullary contents were taken for study. The wound was then sutured and a proper dressing applied.

The pseudo-articular fibrous sac found in delayed union of complete fractures exhibits too little vascularity to supply blood in such amount or under such tension. This clinical manifestation simply suggested that the fracture was pathological.

Diagnosis.—During the operation I thought the pathogenesis of the fracture was probably that of a sarcoma, owing to the apparent vascularity of the structure, which furnished so much blood on the not severe manipulative process instituted by Dr. Holmes two weeks previously. I remarked the absence of any tumor structure adherent to the inner surface of the sac, but concluded that in that friable, predominantly cellular structure, small

round-celled sarcoma, the tissue might easily have been completely separated from the sac and pulpified by the attrition process heretofore described.

The specimens taken from the case were prepared for microscopical study by Dr. P. B. Conant, interne in the West Side Hospital, who with others, including myself, diagnosed sarcoma. A portion of the microscopically prepared specimen was sent to Professor W. A. Evans, at the Columbus Laboratory, who reported that parts of the field suggested sarcoma, but that he was not satisfied with the mounting of the section, and requested a piece of the original gross specimen for further study. I regretted that we were unable to furnish Dr. Evans with more of the tissue. I took a slide from the same block that Professor Evans had sections from to Professor L. Hektoen at his laboratory in Rush Medical College. Dr. Hektoen examined the specimen, and said that he would not like to make a diagnosis from this microscopic section alone. He later made an examination of the patient in the West Side Hospital without noting evidence of pathological lesion beyond the fractured limb. No diagnosis was made. I am deeply indebted to Professor Hektoen for the interest taken in this case. He kindly offered to assume the responsibility to furnish a pathological report of the case, and the gross specimen was turned over to him, and through his laboratory the excellent work of Dr. Davis was secured, the report of which will follow my own.

Specimens of blood and of bone marrow were taken by Dr. Fred Harris, pathologist of Cook County Hospital. Dr. Harris's investigation was interrupted by his sudden departure for Europe, and no report was received from him.

Urinalysis had been made (November 24) on the patient's entrance to the hospital,—the ordinary examination to know the condition of the kidneys, with the view of determining the selection of an anæsthetic or contraindication to surgical intervention, etc. Such examination showed:

Color, cloudy; odor, normal; sp. gr., 1020; reaction, slightly acid; albumen, slight; sugar, negative; microscope, some pus. (Dr. Conant.)

Blood count was made by Dr. Conant at this time (November 24), showing red, 3,704,000; white, 6800.

Differential Diagnosis.—One week following my first operation, and during the time that others mentioned were studying the

case for diagnosis, I took the patient into clinic again to exemplify the subject of pathological fractures. It was concluded that we had such to deal with because of

(1) The history of the violence which caused the fracture was that of a force which should not have fractured a normal bone.

(2) Non-union in three months' time.

(3) Total absence of manifestation of regenerative effort (no callus).

(4) The pathological findings of the previous operation.

Of the diseases considered, the differentiation was quickly limited to three:

(1) Osteitis deformans (Paget and Osler).

(2) Osteomalacia (so-called rheumatic form).

(3) Myelogenic sarcoma.

Osteitis Deformans.—Osteitis deformans occurs in individuals past forty and is oftenest in advanced age. In looking up the recent literature of osteitis deformans I find that the disease appears earlier. In Morton Price's paper (*American Journal of Medical Sciences,* November, 1902), he mentions Kirkbride's collection of sixty-six cases of osteitis deformans, in eleven of which the disease began before the age of forty. Prince, in quoting from Drs. Packard and Steele, says that in osteitis deformans "the bones become exceedingly thickened and asymmetrical, but since the new bone tissue remains uncalcified, its elasticity permits of great deformity of the long bone from the weight of the body, and fractures do not occur."

Accompanied by moderate rheumatic pains, there gradually develops an irregular nodular thickening of various bones, together with increasing curvature and deformity of the parts exposed to pressure by the weight of the body, namely, the spinal column and the legs.

Microscopic studies of von Recklinghausen and H. Stilling: The disease begins with the absorption by means of Howship's lacunæ and Volkman's canals, and the bone may become very spongy, porous, and even cystic. Simultaneously there occurs growth by apposition from the periosteum and medulla, but the osteoid tissue often remains uncalcified for a long time, so that deformities develop. The nature of the disease is not understood. Richard and Ziegler look upon it as the same process that takes place in joints in arthritis deformans, while Recklinghausen speaks of it as a fibrous osteoplastic osteitis allied to osteomalacia.

Osteomalacia.—" Osteomalacia (mollities ossium, malacosteon, halisteresis ossium) is a chronic progressive disease of adults, characterized by decalcification of pre-existing old bone (halisteresis) and by non-calcification of new-formed osteoid tissue, observed most frequently in pregnant or prolific women (puerperal form), but also in children, women, men (rheumatic form), and in old age (senile form). May be sporadic; endemic in certain Rhine districts."

George Dock (*American Journal of Medical Sciences,* 1895), an excellent paper on osteomalacia, in considering the diagnosis, says: " Like all rare diseases, osteomalacia is frequently not diagnosed. Many text-books make it appear that, in later stages at least, the disease cannot be mistaken;" and he further remarks that it seems desirable that the differential points be alluded to more frequently than they are, in connection with which osteomalacia may be mistaken. " Even in Europe, in localities where the disease is not uncommon, cases are very frequently treated up to a late period for other diseases. Sternberg has recently called attention to the difficulty of diagnosis, and has given the important differential points to be sought for in distinguishing between osteomalacia and the diseases for which it is more easily mistaken."

Dock's observations, after his most careful study of osteomalacia in this country, are of great interest. In his own words, " The peculiar distribution of osteomalacia in various parts of Europe is such as to suggest local causes, and led me to examine the history of the disease in North America. Cases of ' mollities ossium,' ' malacosteon,' ' fragilitas ossium;' and ' ostemalacia' have been frequently reported in the medical journals. I have examined all those under various headings in the Index Catalogue and the Index Medicus, but find that only a small number can be considered as genuine cases of osteomalacia. Most of them are cases of osteomyelitis, caries, tuberculosis, sarcomatosis, cancer, or fragility." He further remarks that " Excluding the doubtful cases of Ellis, French, and Russell, the total number of those reported is only ten; all of these cases were females and whites." " Three of the cases occurred in Massachusetts, two in Ohio, one on an island in the Ohio River, two in Minnesota, one in Virginia, and one in the District of Columbia. All of the patients seem to have been of American birth."

With Dock's case from Michigan, the total number of osteo-

malacia cases reported in this country up to 1895 was eleven, and all of these were females.

The rarity of the affection, and the absence of recognized lesions in other bones, sufficed to render this disease as improbable.

" Myelogenic sarcoma."

(1) Myeloid or central osteosarcoma, usually a mixed-cell tumor.

(2) Richly cellular, round, or, more rarely, spindle celled.

(3) Alveolar.

(4) Myeloma.

(1) The age of the patient.

(2) The frequency of this affection.

(3) The absence of recognized manifestations of the lesion in other bones.

(4) The location of the fracture (in the shaft of long bone).

(5) The demonstration of Bence Jones albumose made by Dr. Conant, who brought the test-tube into this clinic (Bence Jones albumose is found in osteomalacia).

(6) The microscopic and macroscopic findings.

(7) In fact, with nothing apparent to negative sarcoma, that diagnosis was made.

Treatment.—The patient was notified as to the diagnosis, and the advice given him to have the entire extremity removed.

At the instance of his relatives, Dr. Frederick C. Schaefer was consulted with the day before the operation. After due consideration of the history of the case, a physical examination and the microscopic specimen, Dr. Schaefer concurred in the diagnosis, but advised a shoulder amputation instead of that of the entire extremity, on the ground that the pathological fracture was low in the humerus, and there was no apparent involvement higher in the bone. I hesitatingly accepted Dr. Schaefer's advice, and the following day amputated through the shoulder-joint.

Wyeth's pins were used to render the amputation comparatively bloodless.

On opening the shoulder-joint, a yellowish, syrupy liquid to the amount of about a drachm escaped. The head of the humerus exhibited the crackling sensation under the fingers, like that of the shaft about the seat of the fracture; and the shaft below the head was likewise soft. These conditions aroused the suspicion of an error in diagnosis, and immediately on closing the stump the ex-

amination of the bones of the amputated limb was made. I fractured at will, with very slight force, the bones of the forearm and the fingers. At once in my own mind I was satisfied that we had a case of osteomalacia to deal with.

Subsequent History.—Then began the investigation which cleared up the case, from the development of a more accurate history to the conclusive evidence rendered by the pathologist, Dr. Davis.

The amputation was done on December 18, 1902, and four days after, the patient was put on phosphorus, gr. $^1/_{100}$, t.i.d., which he continued taking for twelve days, when he left the hospital. Since that time he has taken no medicine, although it was my intention to have the phosphorus continued.

Examination of urine seven days after amputation, December 15, 1902:

Sulphuric acid, three grams; phosphoric acid, five grams; sodium chloride, thirteen grams.

Total amount of urine in twenty-four hours, 1218.75 cubic centimetres.

Test-tube measurements showing percentage of precipitate, 50 per cent.

After the first operation the patient showed no nerve or muscular symptoms, but in a few days there was noted a muscular weakness in the forearm and hand, and, later, complete muscular paralysis. There was no apparent sensory disturbance. The reflexes were normal.

Skiagrams.—Although many skiagrams were made, including the whole skeleton, the work was so poorly done by a novice in skiagraphy, that little value is attached to them. In one picture some of the ribs show tortuosity and but faint outline, the former symptom being, of course, of great significance, the latter being uncertain. I have tried to get the patient to have other pictures made, but could never get him to the hospital again. I ordered a skiagram of the fractured humerus made so that I could use it at my clinic on differential diagnosis. On inquiry for it, I was told that the work had been a failure and the negative had been destroyed. Later I saw a piece of the broken plate (Fig. 1), which had been very well made, but because the outline of the bone was scarcely discernible, it was thought to be a failure and the plate was destroyed.

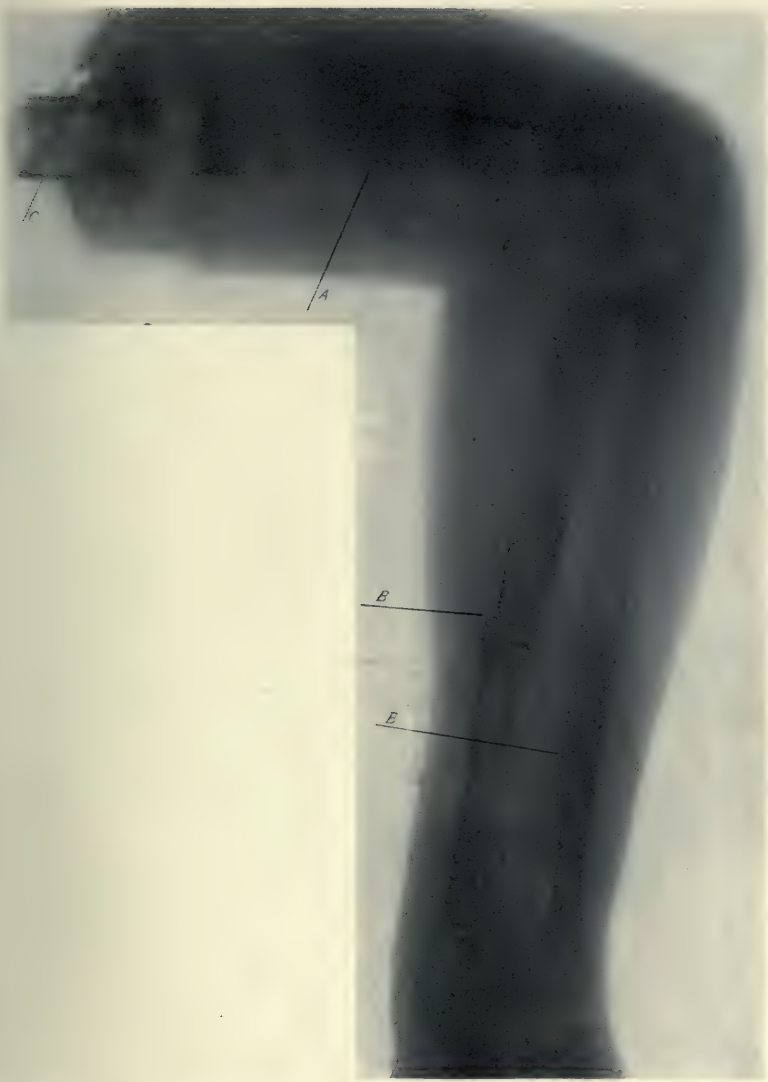


FIG. 1.—*A*, seat of pathological fracture. *B* and *B*, fractures made with slight force after arm was amputated. *C*, mere shell of bone left of upper part of humerus.



FIG. 2.—Showing lower extremities normal, but narrowing of chest in lateral diameter, and bulging of chest in anterior region.

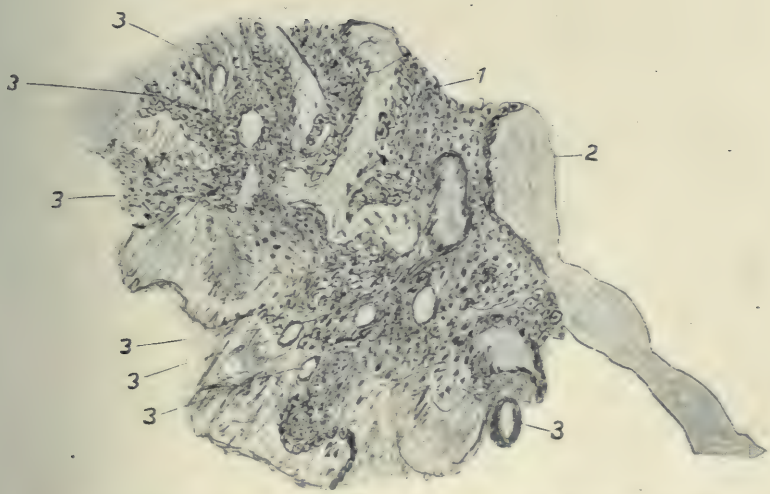


FIG. 3.—Drawing made from first microscopic section of osteomalacia case.

1. Sarcomatous cells.
2. Decalcified bone, due to the sarcomatous tissue infiltration.
3. Blood-vessels that have no wall structure and are just blood-spaces.

Mensuration.—The photograph shown in Fig. 2 was taken for the purpose of comparative mensuration, from which I have not yet made systematic conclusive deductions. The shortened lateral and increased anteroposterior thoracic diameters and the spinal curvatures are quite apparent.

A few days after the amputation, I found undue resiliency of the ribs on the right side. They were the only bones which were palpably soft.

Drawing of Microscopic Specimens.—The drawing shown in Fig. 3 was made by Dr. Conant from the microscopic slide such as was presented to Professors Evans and Hektoen. Suffice it to say that the histological construction observed is that of small round-cell sarcoma, of osteomalacia, or of inflammation, which emphasizes the importance of using but one eye for the microscope, leaving the other free for wider observation.

On February 1, 1903, the patient and his wife visited my office. In answer to my inquiry as to whether she had noticed any change whatsoever, either physical or mental, in Mr. Jensen since she had known him (which has been for the past twelve years), Mrs. Jensen answered: "Well, of course he has been more quiet, and didn't care whether he lived or died."

"When did you first notice such a change?"

"Well, about the time when he first began to have the rheumatism, beginning about three years ago. Years ago he was as straight as any one, and he was very quick at motion; very active. Now he is very stooped, round-shouldered, and very stupid. These changes began to appear about the same time that the rheumatism appeared."

The patient volunteered the information, several months after the operation (January 10, 1904), that he used to walk with a cane on account of pain and weakness in his back, for years before his operation. The occasion for the remark was my inquiry as to how he had felt since the amputation of his arm. He said, "Before I had my operation I walked with a cane; had pains in my spine and limbs. Now I can run a race with any one. I don't have any pains, and don't carry a cane."

The patient has been working in the same piano factory, since shortly after the amputation of his arm, as a wood polisher. His work requires the expenditure of very much more physical force than he had used for years previously. He feels stronger than he has been for three years and seems in good health and spirits.

Remarks.—(1) It is probable that this is the first demonstrated case of osteomalacia in the male reported in North America.

(2) Those who have prescribed phosphorus for osteomalacia have not observed any effect from it until it has been administered for a long time, and as this patient took the drug in $^1/_{100}$ gr. doses t.i.d. from December 12–24, 1902, twelve days only, the improvement in his condition is not to be attributed to it.

(3) There can be no doubt but that improvement in cases of osteomalacia has followed oöphorectomy, and no satisfactory explanation of its *modus operandi* has as yet been advanced. It would be interesting to know what influence the operation has had on my case. It must not be lost sight of that the improvement may be only temporary, and the disease may possibly be running its course, without even modification from any treatment. A knowledge of the enormous mortality of osteomalacia renders some relief to the author, who has felt the pangs of discomforture in operating under mistaken diagnosis. J. B. Hellier (London *Lancet,* 1895, i, 807), from Litzman, gives mortality of puerperal form at 70 per cent.; of non-puerperal form, 84.7 per cent.

No history has been found of serviceable union taking place in osteomalacia.

Conclusions.—Retrospectively, taking the symptomatology as completely evolved in this case, the simplicity of diagnosis is quite apparent. With but a slight knowledge of the disease, the inference could scarcely be incorrect. But taken at such a time as that previous to surgical intervention, the diagnosis is not so easy. These were the

Objective Symptoms:—(1) Shortening of stature. (2) Curvature of spine. (3) Barrel-shaped chest; none of which had been noticed by the patient; and the

Subjective Symptoms of Rheumatoid Pains in the extremities and spine, with possible mental manifestations of stupidity and a mild degree of melancholia and myasthenia.

As to the *objective* symptoms, one commonly meets with

them among laboring people without attempting to determine the cause, as to rickets or occupation, etc. There was nothing characteristic about the pains complained of, and it is yet questionable as to the mental disturbance. It is quite clear that there is no individual pathognomonic symptom of osteomalacia, and still authors have expressed astonishment at the late date of recognition, or complete failure to diagnose the disease. At the present time, with no knowledge of the cause of the disease, hence its real nature, it cannot be recognized until advanced bone changes have taken place.

In reviewing the history of a large number of cases, the author finds that the symptoms almost universally mentioned are rheumatoid pains in the extremities and spine, without swelling, accompanied by myasthenia, these symptoms preceding for some months deformity and fracture. With the history of such symptoms, the X-ray should show the lessened density of the bones and serve to establish a diagnosis.

PATHOLOGICAL REPORT BY DR. D. J. DAVIS.

The amputation of the arm, already described, was made at the shoulder, the head and upper part of the humerus at the time of the operation being in a friable and crumbled condition. It was at once preserved in formalin, and later dissected and examined.

Gross Anatomy.—There was some œdema of the whole arm. The muscles and nerves showed no important changes. The blood-vessels were normal, except for a few thrombi in the smaller superficial veins just above the elbow-joint. The epitrochlear gland was slightly enlarged. In the elbow and carpal joints there were small masses of a yellowish, gelatinous substance. This was probably coagulated effusion in the joints. Otherwise the joints appeared normal.

About twelve centimetres from its distal end the humerus presented a complete fracture. The fractured ends were very irregular. There was here only a thin shell of cortex remaining, and this contained but little calcareous matter. Below the fracture for about five centimetres the bone was slightly enlarged and quite firm. Its surface was very irregular, and the mineral salts almost entirely absent. On cross-section the medullary cavity was filled with dark, firm, clotted blood which was undergoing organization,

as evidenced by the strands of light connective tissue penetrating it. Near the seat of fracture occurred cystic cavities filled with a bloody, serous fluid. These changes were apparently incident to the fracture.

Above and below the lesion just described the surface of the bone appeared porous. The cortex was thin and spongy, this sponginess increasing from without inward. The articular extremity of the bone also was very spongy. So little lime salts remained in the bone that it could be easily cut with a scalpel. However, it was not especially pliable or waxy, but rather somewhat brittle. In cutting through the bone it would crack in advance of the knife-blade. Also a lateral strain would break rather than bend it. Most of the marrow of the humerus was dark red, this being due to the blood from the site of the fracture. The bones of the forearm and hand showed the same spongy condition with thinning of the cortex and loss of lime salts. The marrow of these bones was light colored or slightly yellowish in places. There were, however, a few small red areas, some sharply localized, other containing for some distance near the cortex in a linear direction. Near the extremities of the radius and also in the metacarpal bones were found a few small cysts filled with a light-colored, gelatinous material. These were not numerous and none measured over five millimetres in diameter. There were no irregularities or nodosities of any kind observable on the bones. The periosteum was slightly thicker than normal.

The size of the bones was not altered to any great degree. There was no evidence of any osteosclerosis.

Upon boiling a piece of bone for one or two hours it became quite pliable; also when macerated in water or digested with pepsin. Boiling in caustic soda reduced the bone to a friable mass, which fell to pieces on handling. The spongy condition of the bone was brought out very clearly by drying.

Microscopic Anatomy.—Sections were made of the triceps muscle, the musculospiral nerve, blood-vessels, the epitrochlear lymph gland, the humerus, radius, ulna, one of the metacarpal bones, and also from different parts about the fracture of the humerus.

The triceps muscle shows a slight cellular infiltration. The nerve, blood-vessels, and lymph gland appear unaltered.

Sections from the different bones were stained with hæma-

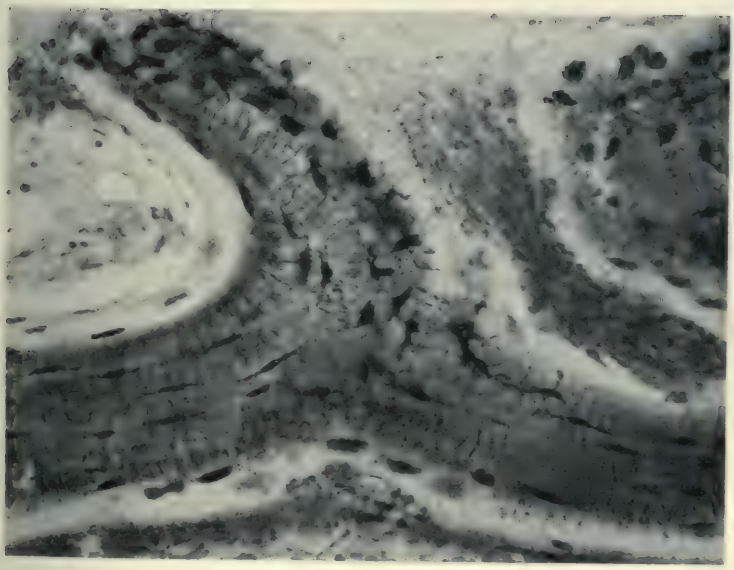


FIG. 4.—Photograph showing zone of osteoid tissue on margin of trabecula of bone. This zone is light colored; contains no canaliculi. Only a few narrow slits, seen on the left, remaining of bone-cells.

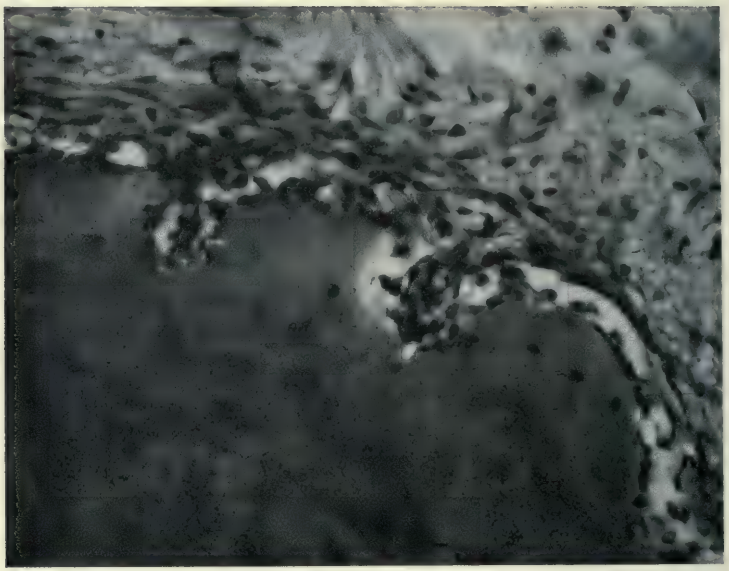


FIG. 5.—Photograph showing recesses into the osteoid margin of the trabecula filled with small round or oval cells.

toxylin, and eosin, hæmatoxylin and carmine, thionin and picric acid (Schmorl's method), and van Gieson's stain.

Sections of the humerus show the bone to be in a very spongy condition, this sponginess increasing towards the medullary cavity. The trabeculæ are thin and far apart, and usually appear as a narrow strip of bone tissue. The Haversian canals are much enlarged. The margin of the trabeculæ stains a deep red with carmine, giving a well-marked "carmine border." With thionin and picric acid the border stains a light yellow, while the central portion stains green and the bone-cells dark red. In this border the bone-cells are small and flat, most of them appearing as thin, narrow slits (Fig. 4). Apparently many have disappeared. No canaliculi are seen here. The carmine border is quite uniform in thickness, measuring from twelve to fifteen microns in width. It is seen practically everywhere on the margin of the trabeculæ. It appears more homogeneous than the central portion, though often a distinct lamellation can be observed. It is entirely devoid of lime salts.

In the interior portion of the trabeculæ the bone-cells are slightly larger than normal. The canaliculi show very clearly with Schmorl's stain. This part of the trabeculæ contains a considerable amount of lime salts. There was little difficulty in cutting sections of the different bones without previous decalcifying. With hæmatoxylin and eosin the interior portion of the trabeculæ stains a deep blue. It is not homogeneous, but appears granular and friable.

Along the margin of the trabeculæ, especially near the periosteum, where the bone tissue is more abundant, there can be seen little recesses into the trabeculæ (Fig. 5). Rarely giant cells are found in these recesses. In most of them is a group of small cells with round or oval nuclei which seem to be streaming in from the surrounding medullary tissue. They are often in close apposition to the wall of the recess, and the border in advance of them seems to be undergoing disintegration. It suggests strongly that a process of dissolution is occurring here. Along the border of the trabeculæ almost everywhere are seen cells, usually elongated, but often globular in form.

The marrow, on the whole, contains a large amount of fat, but near the cortex and between the trabeculæ of bone the space is occupied largely with a loose, fibrous tissue with only a slight

amount of fat. In a few small, localized areas usually near the cortex are seen aggregates of small cells having a round nucleus and a moderate amount of protoplasm, and occasionally a giant cell is seen. In these areas, also, there is some fat. The blood-vessels are not numerous, nor are they congested. In several places there is a slight hæmorrhage into the marrow.

Sections of the humerus near the seat of fracture show the medullary cavity filled with blood, fibrin, and serum, which are undergoing organization. Osteoid tissue occurs here in abundance. Along the margin of this tissue are a large number of osteoblasts (Fig. 6). Occasionally giant cells are seen. In some of the older trabeculæ in this region there are seen to be some lime salts present. Evidently this is the site of a reparative process.

Examination of the radius, ulna, and a metacarpal bone shows that the same condition is present in these bones as that already described for the humerus, the only difference being the changes noted in the humerus brought about by the occurrence of the fracture. Sections taken at some distance from this fracture show changes of the same nature that are general in all of the bones examined.

From the above description we have to do apparently with a case which shows many of the typical findings of osteomalacia. McWilliams speaks of osteomalacia fragilis and osteomalacia cerea or waxy osteomalacia. These are probably only different stages of the same process, the fragility of the bones preceding the waxy condition. From the fragile nature of the bones and the ease with which they are broken we have probably to do with the earlier stages of the disease. The general deficiency of lime salts, the spongy condition of the bones, the small cystic spaces, the very characteristic microscopic appearance, the fatty marrow, all point strongly to osteomalacia. It is to be noted that all parts accessible to examination presented the same spongy condition, and about to the same degree. This is very significant, as it indicates a process that at least has affected the entire upper extremity. Evidences of the process going on in other parts of the body are the curvature of the spine, the irregularities of the ribs as shown by the X-ray, the stoop-shouldered position of the man, and the diminution in stature.

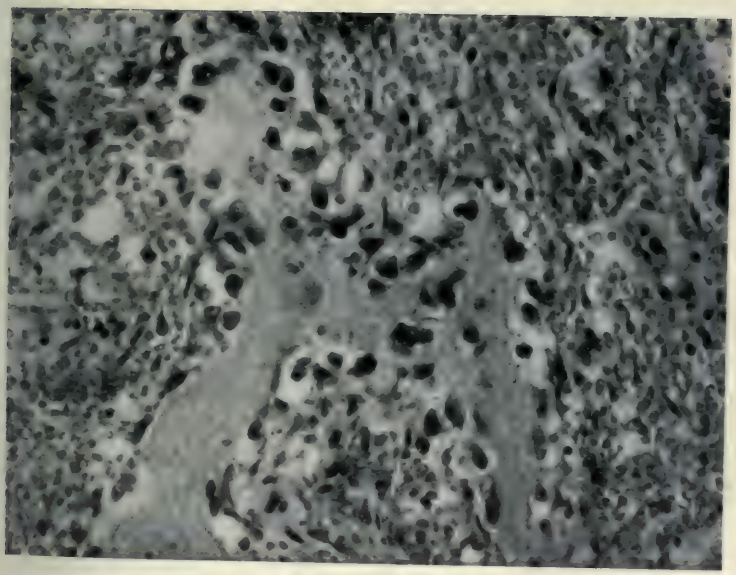


FIG. 6.—Photograph showing the formation of new bone near the seat of fracture in the humerus. Numerous osteoblasts seen on the margin of osteoid tissue surrounded by red blood-cells and connective-tissue cells.

As to the nature of the process in this case we may perhaps obtain a few suggestions from the microscopic findings. The fairly uniform dissolution of bone substance along the margin of the trabeculæ as indicated by the different staining reaction here obtained, the degenerated condition of the bone corpuscles and the absence of canaliculi, indicate that some factor has to do with the solution of bone at the surface of the trabeculæ. This process is commonly known as halisteresis ossium. There is also some evidence to indicate that the change is not limited entirely to the margin of the trabeculæ. The central portions, as stated above, appear granular and friable, and the bone-cells slightly larger. This may indicate some abnormal action of the bone-cells themselves.

Just how the solution of bone is brought about is not known. But it would seem safe to assert that it is not due to the action of osteoclasts, for they are rarely seen. One is struck especially by the uniformity of the layer of decalcified, or, as it is often called, osteoid tissue at the margin of the trabeculæ. It would appear that there is first a decalcification of the bone tissues, and later this decalcified tissue is absorbed by some process. That the decalcification is accomplished by means of an acid is a very attractive hypothesis. Rindfleisch in 1864 first advocated this theory. He found that by putting bone into acid for a time he could obtain a carmine border similar to that observed in osteomalacia. He suggested that the decalcification was due to carbonic acid resulting from congestion and stagnation of the blood. This theory has fallen for want of any facts on which to base it. The process of absorption may be explained by the presence of the round cells occurring in the recesses and on the trabeculæ as described above. These cells look very much like osteoblasts. However, they may be engaged in an absorptive process. Gayet and Bonnet, two French observers, have described similar cells in osteomalacia, and ascribe to them the power of absorption. It certainly looks reasonable to assume that the cells are engaged in the disintegration of the already decalcified tissue, and from what we know of such processes it is undoubtedly one of digestion.

The carmine border or osteoid zone is not characteristic of osteomalacia. It has been observed in practically all cases where absorption or rarefaction is occurring. Ribbert found it in bones the seat of tumor, ovaries, syphilis, and senile osteomalacia. Stilling describes it in a case of osteitis deformans.

THEORIES OF THE PATHOGENESIS OF OSTEOMALACIA.

The theories advanced to explain osteomalacia may be grouped under four heads,—the acid, toxic, infectious, and nervous.

Acid Theories.—The decalcification has been ascribed to various acids. Lactic acid has been found in bones and marrow in cases of osteomalacia. Experiments made by feeding animals with large quantities of lactic acid for a long period of time have resulted negatively. As already stated, Rindfleisch suggested that carbonic acid resulting from hyperæmia accumulated in sufficient quantity to cause a solution of bone. In many cases of osteomalacia there is apparently no hyperæmia of the bones. This is true in our case. There are a few red areas, but these are not due to congestion. There is little that speaks in favor of this theory.

Acids resulting from gastric fermentation (Bouchard) and also oxalic acid have been suggested as possible causes, but there is nothing to substantiate such views.

Toxic Theory.—From the large number of successful cases reported after removal of the ovaries in women affected with osteomalacia, it would seem certain that there is some relationship between the trophic disturbances in osteomalacia and these organs. What this is has not been determined. An internal secretion of the ovaries is naturally suggested to explain this. Experiments with animals indicate that the administration of an ovarian extract increases the elimination of phosphates, increases metabolism in general, and in large doses causes death, but softening of the bones has never been produced in this way.

Hyperæmia, excessive development of the blood-vessels, and hyaline changes in the vessel walls have been found in

the ovaries of women suffering from osteomalacia. But these lesions are by no means constant in the disease.

So far as I can learn, no case of osteomalacia in the male has been treated by castration.

Infectious Theory.—Petrone, in 1892, claimed that he had discovered an organism—the micrococcus nitrificans—which produced softening of the bones when injected into dogs, and that this organism was the cause of osteomalacia. Also he claimed to have cured the disease by the administration of chloroform, this substance destroying the microbe in vitro. This work has been completely disproved by the later researches of Fehling, Curatulo, Tarulli, and others.

More recently Morpurgo produced a softening of bones in white rats by inoculation with a diplococcus. The bones showed a typical decalcification. Inoculation of new-born rats produced changes simulating rickets in the human.

Osteomalacia has been observed following puerperal fever, and also following a long suppurating process of the biliary tract in a bitch.

The evidence for an infectious theory of osteomalacia is very meagre, to say the least. While it is a very attractive explanation, much stronger evidence is necessary before the theory can command serious consideration.

Nervous Theory.—No constant lesions have ever been found in the central or peripheral nervous systems in cases of osteomalacia. There are, however, several features of the disease that suggest a nervous origin. The pains in various parts of the body, the general myasthenia, and the change in the mental condition of the patient suggest a nervous trouble. Fehling claimed that a hypersecretion of the ovaries caused a hyperæmia by acting through the vasodilator nerves of the sympathetic nervous system. Then, again, we are familiar with the numerous joint and bone diseases associated with lesions of the nervous system. Also the local softening and porosis that occur in connection with tumors, syphilis, fractures, etc., may be attributed to disturbances of nutrition due to interference with the trophic-nerve supply.

All of these conditions, then, may be grouped together and

attributed to a disturbance of nutrition due to (1) lesions of the central nervous system, (2) lesions of the peripheral nervous system, and (3) causes acting reflexly as the ovarian secretion. This view is strongly emphasized by Gayet and Bonnet.

But it must be admitted that the theory of a trophoneurosis is not satisfactory. It is extremely indefinite. It is but little more than another way of saying that we know nothing about the process; and then there is the danger of contenting ourselves with the application of a meaningless term to the process, instead of pursuing further careful experimentation and observation.

From the above brief *résumé* of the theories advanced to explain osteomalacia, we see that there is none which is satisfactory. It is quite likely that softening of bones is produced in a variety of ways, and that different forms probably require entirely different explanations.

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PHYSIOLOGICAL SALT SOLUTION.[1]

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THE use of salt solutions by the hypodermic or intravenous method for hæmorrhage, shock, uræmia, diabetes, cholera, intoxications, autointoxications, septic, and other conditions, seems constantly widening, yet comparatively little attention is paid to the constitution of the fluid used. When attention has been given to the subject, the recipe suggested often shows a failure to appreciate the principles involved. This will be evident when it is stated that solutions containing carbolic acid, alcohol, sugar, sea-water, strong salines, and solutions with every base and acid found in the ash of blood-plasma have their advocates.

It needs no argument to show that a fluid should be used which will not interfere with the performance of the blood's functions nor injure the body cells.

We may take as an index of the effect on cells in general the effect on red blood-cells. If the solution is too concentrated the red cells shrink, if too dilute they first swell and later part with their hæmoglobin.

The question of swelling or shrinking of the cells is not determined by the chemical composition of the fluid or actual weight of dissolved matter, but by its osmotic effect.

The Osmotic Behavior of Blood-plasma and Saline Solutions.—Blood-plasma is such a complex mixture of organic and inorganic ingredients that there is no *direct* method of determining its osmotic pressure. Fortunately, this is of little consequence, since there is such an accurate *indirect* method. This method is based on the fact that two solutions having the

[1] This paper contains part of a discourse to the Roosevelt Hospital Alumni Association, February, 1904.

same freezing point have the same osmotic pressure, irrespective of the nature of the dissolved substances.[1] Otherwise stated, the depression of the freezing point of a solution is proportional to the number of dissolved molecules and not to their nature, with this exception, however, that if the dissolved substance dissociates into its ions on going into solution, each ion has the effect of a whole molecule upon the freezing point.*

The freezing point of human blood is —56° C. In health it varies but slightly from this figure in either direction. A depression of the freezing point of .03° or .04° C. may indicate a considerable renal insufficiency.[9]

The point to be emphasized here is the constancy in health of the freezing point, and consequently of osmotic pressure. Hamburger [13] has shown that this pressure does not change during hæmorrhage.

Hæmatocrit [2] determinations of the salt solution in which red cells neither swell nor shrink give .9 per cent. as the proper concentration. A .9 per cent. sodium chloride solution is found, too, to freeze at about the same temperature as blood-plasma. Chemical analyses of the plasma, and computing the sodium as a chloride, give .84 per cent. as the amount of salt in human plasma. From these determinations it is clear that the osmotic pressure of blood is equivalent to that of a sodium chloride solution of from .84 to .9 per cent. concentration.

The writer has frequently performed the following experiment: Defibrinated blood was got from an umbilical cord and one cubic centimetre placed in each of three test-tubes. Then salt solutions were added to make five cubic centimetres of a mixture of blood and salt solution. Such strengths were used that the corpuscles in one were in .9 per cent.; in another in .6 per cent., and in the third in .5 per cent. salt solution. The corpuscles in .9 per cent. solution settle, leaving a clear fluid above. Those in the .6 per cent. solution settle, but make a larger mass, showing swelling of individual corpuscles. The supernatant fluid moreover is colored red, showing a slight

* The osmotic pressure also varies with the absolute temperature.

hæmolysis. The .5 per cent. solution completely destroys the corpuscles and makes a uniform translucent red solution, in other words, *lakes*.

The solution in which complete hæmolysis occurs is said to be .58 per cent.[1]

In view of these facts, it seems remarkable that the impression is so widespread that a .6 per cent. salt solution is "physiological." This solution is isotonic with frog's corpuscles, and it seems to have been assumed to be on that account innocuous to human corpuscles.

Experiment as above mentioned will show both swelling of corpuscles and a beginning of laking on placing human corpuscles in a .6 per cent. salt solution.

The Necessity of Sodium Potassium and Calcium Salts in Blood-plasma.—Some years ago Ringer, of Cambridge, noted, in experimenting on the irritability of frog's muscle in solutions of .6 per cent. sodium chloride, that irritability remained longer if he did not use distilled water in making his solutions. Further, he found that the advantage of tap water lay in the contamination of his source of supply with calcium and potassium salts.

Howell[3] and others, in experimenting on the heart muscles of frogs and turtles, showed that rhythmic contractions soon cease in physiological sodium chloride solutions, and that after rhythmic contractions have ceased they may be brought back for a time by adding Martius's "alkaline physiological solution." When they have again ceased, the use of a "balanced solution" *—one containing sodium potassium and calcium—causes a return of the rhythmic contractions, which may continue many hours.

Cushing[4] performed the following experiment on frogs: The aorta was opened and a solution of .6 per cent. salt was passed through the vessels during the time of the experiment. The gastrocnemius was then stimulated through its nerve, and

* The term "balanced" solution has been introduced by Loeb to signify a solution of sodium, potassium, and calcium in proper proportions.

was found to lose its irritability sooner than if no circulation were maintained through the muscles, though, of course, in the muscle stimulated, but without circulation, the waste products of contraction must accumulate in the muscle. After irritability to indirect electrical stimulation had ceased in the muscle with the salt solution circulating through its vessels, it could be made to reappear on adding calcium and potassium to the solution.

We know that calcium is necessary to the clotting of blood and to other body functions, such as the action of rennin on milk. Heart muscle contracting in blood serum is poisoned by addition of enough sodium oxalate to form an insoluble calcium oxalate with the small amount of calcium present.

In an article just published, O. H. Brown [11] has recorded some observations which are of interest as further evidence of the physiological importance of calcium in the blood. He anæsthetized rabbits, determined after an hour's anæsthesia that no sugar was present in the urine, and then produced diuresis by infusions of a variety of saline solutions of about the concentration of plasma. Among the solutions used was a physiological sodium chloride one. In nearly every case sugar appeared in the urine. He then added calcium to his infusion solution, and as a result found glycosuria to diminish or disappear. Even after injections of phloridzin, he found that the sugar elimination was diminished by injections of calcium.

Much experimental work has been done, notably by Loeb,[5] Howell,[3] and others, to show the part played by the calcium, sodium, and potassium, respectively, in the plasma. Howell's conclusion is that the sodium maintains the proper osmotic relations between the body cells and fluids, that the calcium is the stimulating agent to heart muscle, and that potassium is essential to its rhythmical contraction and relaxation. At any rate, calcium and potassium, though present in such small quantities in the plasma, are much more abundant in body cells, and without the small quantity in the plasma these metals would be dissolved out of the cells.

These small quantities of potassium and calcium in plasma are not then to be looked upon as accidental, but essential constituents of it.

The Reaction of Blood.—Blood is always and necessarily alkaline. This alkalinity is essential to its carbonic-acid carrying power; it neutralizes the sarcolactic acid formed in tissue metabolism, and is related to its bactericidal action. Thus, conditions such as diabetes, with lessened alkalinity, show lessened resistance to incursions of bacteria.

The alkalinity of plasma is due to phosphates and carbonates, and is equal to that of a .35 per cent. sodium carbonate solution.

The Quantity of Sodium Potassium and Calcium in the Blood.—In Table I the amount of sodium potassium and calcium given in the analysis of plasma contained in Schaefer's "Physiology," Vol. i, page 153, have been taken and computed as though entirely combined as chlorides.

TABLE I.

THE QUANTITY OF SODIUM, POTASSIUM, AND CALCIUM OF BLOOD-PLASMA, CONSIDERING THEM AS TOTALLY COMBINED AS CHLORIDES.

	Per Cent.	Grammes per Litre.	Grains per Quart.
Sodium chloride	.84	8.4	129.
Potassium chloride	.06	.6	9.2
Calcium chloride	.032	.32	4.9

It will be noted that the amount of sodium chloride, .84 per cent., is less than the figure given as "physiological." The difference between .84 and .9 per cent. probably represents the amount contributed to the osmotic effect by the many other compounds of the plasma.

For practical purposes, it will be best to consider the saline equivalent of plasma as .9 per cent., nine grammes to the litre, or 138 grains to the quart.

In Table II there is given for comparison in the first column the saline constitution of plasma based on analysis, and in the following columns, solutions suggested or used for infusion.

TABLE II.

CONSTITUTION OF "PHYSIOLOGICAL" SALT SOLUTIONS IN USE BY SURGEONS.

	Per Cent.	"Normal Salt Solution."	Ringer.	Mikulicz.	Halstead.	Tavel.	Szumann.
Sodium chloride ...	.84	0.6	.8	.9	.9	.75	.6
Potassium chloride..	.06	..	.03	.01	.03	..	..
Calcium chloride ..	.032	..	.026	.02	.01	..	..
Alkalinity reckoned as sodium carbonate	.35	..	..	..	..	.25	.1
Water	100	100	100	100	100	100	100

Referring to column one it is to be noted that we cannot have calcium chloride and sodium carbonate present in the same saline solution, as the calcium would be precipitated as a carbonate. The addition of phosphates and sulphates to the solution has its advocates, as these are present in plasma, but this seems unnecessary, as we cannot be sure that our mixture of bases and acids will combine in the same way as in blood-plasma.

In column two is placed the solution in most general use, and it may be noted that it is far from physiological. Column three shows the solution suggested for use in mammals by Ringer, and is based upon much physiological experimentation.

Mikulicz's solution seems too weak in potassium.

Column five shows the solution which Bloodgood [7] says was introduced by Cushing three years ago in Halstead's clinic, and which has given entire satisfaction. As a reason for the small calcium percentage, Bloodgood refers to the experiments of Dawson [6] on infusion after hæmorrhage in dogs. Four dogs which had been infused with Ringer's fluid died, and Dawson thinks the .026 per cent. calcium may have been responsible for their deaths, and advised a less percentage. Two or three times this quantity of calcium has, however, been used in animals without disastrous results, so it would seem that something else must account for his fatalities.

The next solution was devised by Tavel [12] for irrigating wounds, but has been used by others for infusion.

Szumann's fluid is moderately alkaline, but somewhat hypisotonic.

Hypisotonic Infusions.—When a solution such as a .6 per cent. NaCl one is used intravenously, the excess of water necessary to restore the normal osmotic relations may be excreted; fluid may be taken up by the tissues or salts from the tissues may pass into the blood. That the former occurs is apparent when we note the effect of such a solution in a case of hæmorrhage. An infusion of a few hundred cubic centimetres often throws the patient into a profuse sweat even if the temperature be normal or subnormal at the time.

Moreover, there is the likelihood of some hæmolysis if the fluid is thrown rapidly into a vein.

No doubt such solutions have often saved life, but the writer thinks that the more nearly "physiological" solutions would be of greater value. If only a small infusion as compared to the total amount of blood is given, if, further, it is given hypodermically, dilution of the plasma is negligible. But, recalling the constancy of the freezing point of normal plasma, we may be sure, if any dilution or change in proportion of salts occurs, every effort will be made by the body to restore the normal conditions. When we use large and frequently repeated intravenous infusions, it would seem essential that the fluid used should be as nearly as possible "physiological."

This point is mentioned because there is a tendency to combat a variety of intoxications, septic, uræmic, etc., by large infusions given every four to six hours. During the administration of the infusion and for a time afterwards, the pulse may be thought to improve, but may not the reaction, when improper salt solution is used, from hæmolysis, impaired irritability of protoplasm, or profuse sweating, leave the patient in a worse state than before the infusion?

Drainage of the peritoneal cavity in cases of diffuse spreading peritonitis is much less practised than formerly, chiefly because we are *unable* to drain any large part of the cavity for more than a few hours. Instead, we irrigate with large quantities of fluid to remove mechanically the bacteria and toxins and as far as possible to dilute the remainder. We rely on the peritoneal epithelium to combat the remaining in-

fection. We should aim to injure these cells as little as possible, hence the contraindication to the use of antiseptics. But when large quantities of fluid flow over peritoneal surfaces for a considerable time, and the amount of salt is too little, swelling of cells and diminution of bactericidal power must result.

The following statements seem warranted from what has gone before or on the basis of experimental work to which reference is made at the end of the article.

1. It is better not to call a solution used for infusion "normal salt solution," as "normal solution" has a definite chemical significance in no way related to the solution under consideration. Even "physiological" solution admits of some ambiguity. For instance, such a solution for use in the conjunctival sac should have a concentration of 1.4 per cent., since that is the concentration of human tears.[1]

2. Theoretically, we cannot make a perfectly physiological salt solution, though we can make one to answer every practical purpose. As before mentioned, we cannot have one alkaline and at the same time containing calcium salt.

3. Hypodermoclysis is preferable to intravenous infusion when carefully prepared solutions are not available, as in emergency.

4. The water used should be clean, if possible filtered, but not necessarily distilled.

5. Table salt can be used for an emergency solution. This contains, as a rule, besides sodium chloride, calcium * as a chloride or sulphate and magnesium similarly combined. Eight analyses of salt referred to showed 93 to 98.8 per cent. of sodium chloride. An analysis of common salt from Central New York showed no potassium, .1 per cent. $CaSO_4$, .25 per cent. $CaCl_2$.

6. An emergency solution should contain as nearly as possible 138 grains of sodium chloride to the quart.

* Pure sodium chloride is not deliquescent. The deliquescence of table salt is due to its calcium.

7. Where large quantities of salt solution are used, it is convenient to make the "physiological" solution by adding a *measured* quantity of a concentrated stock solution to sterile water. Where it is needed in small quantities, it is convenient to have bottles prepared containing the chlorides in proper quantities to make a "physiological" solution when added to a litre or quart of water. Measuring out salt in a teaspoon to make a solution is too inaccurate.

8. In emergency accuracy is not essential, especially if but one infusion is given. Harm can be done if large and frequent intravenous infusions are used which are not "physiological." A chill and rise of temperature simulating a malarial paroxysm have been frequently noted after infusion.

Cushing [4] suggests that the cause may be the same as in malaria, namely, a destruction of red cells.*

9. After hæmorrhage, the purpose of an infusion is to supply the vessels with fluid. This fluid is only partly retained if the solution used is too dilute, but is lost through skin and kidney. The sweating may further reduce a normal or subnormal temperature. The writer wonders if the fall of temperature often noted after infusion in septic cases is not to be explained by the sweating out of a too watery fluid.

10. In septic cases infusion is certainly indicated if fluid cannot be absorbed through the usual channels. Much has been said in favor of infusion in order to dilute poisons and to hasten the elimination of bacteria and poisons through the kidney. In so doing, it is to be remembered that the antibodies are equally diluted, and that the benefit can only apply to soluble poisons when not already in combination with tissue cells. Experimental evidence is somewhat conflicting as to the value of infusion in septic conditions, but clinical evidence seems to show its value in a variety of bacterial and non-bacterial intoxications. Under these circumstances frequent

* Substances may be injected into the blood which produce hæmolysis of red cells, yet no rise of temperature. This makes it doubtful whether malarial fever is due to hæmolysis.

infusions may be needed, hence the importance of "physiologically balanced" fluids.

11. When large quantities of fluid are used in the peritoneal cavity, they should contain calcium potassium and sodium and in the proper proportions.

12. There seems to be no valid reason for administering infusions or peritoneal irrigations at a temperature higher than that of the blood. A fluid given ten or twelve degrees hotter than the blood cannot by its own heat raise body temperature more than a quarter of a degree. When fever is present, there can be no reason for using a hot solution, nor does it seem likely that peritoneal epithelium would be favorably influenced by subjecting it to a temperature ten degrees above that at which it ordinarily functionates. Thrombosis in the median basilic vein might follow the heating of its wall to this extent. Of course, the infusion fluid cools several degrees in passing through the tube to the vein.

13. As Bloodgood has said, every surgeon should supervise the making of the salt solution which he uses.

From inquiries as to the method of preparing salt solution in various New York City hospitals, it has been discovered that when the surgeon calls for "normal salt solution," thinking, no doubt, to get a .6 per cent. solution, he is in reality, in some instances, getting as low as .5 per cent., in others as high as 2.2 per cent.

14. When accuracy is obtainable in the preparation of the fluid for infusion, it would seem that the following two solutions meet the indications, so far as we know them at present, for a "balanced" and "alkaline" physiological solution respectively.

	Per Cent.
A. Sodium chloride	.9
Potassium chloride	.03
Calcium chloride	.02
Water	100.
B. Sodium chloride	.75
Sodium carbonate	.25
Water	100.

The Choice of a "Balanced" or "Alkaline" Fluid.—The alkaline fluid given above is Tavel's [12] solution, as already mentioned, recommended by him for wound irrigation. This solution he recommended for the purpose because bacteriological investigation showed it to have a marked inhibiting effect on bacterial cultures. Furthermore, it is of about the same reaction as the blood, and we know that the maintenance of this reaction is important in combating sepsis.

But Kuttner has recorded certain bad results following its hypodermic use. He reports six cases of gangrene of the skin at the site of injection of this salt soda and none in his experience when sodium chloride alone was used. It is a fact, however, that gangrene may result from injection of too large a quantity of a solution, even a physiological sodium chloride one, especially if given in dense tissue. Tissue anæmia is probably an important factor in the production of this gangrene.

Kuttner [14] gives experimental evidence to show that the soda is responsible for the gangrene. He made injections of sodium chloride and "salt soda" solution in animals, giving each animal an injection of "salt soda" on one side the body and an equal quantity of sodium chloride solution on the other side. He uniformly noted that it took a longer time for the "salt soda" to be absorbed. He then made injections of more concentrated solutions of salt soda and sodium chloride. The stronger salt soda solutions produced gangrene of the skin, while the sodium chloride solutions did not. In spite of these experiments it seems hard to understand how a solution a little less alkaline than blood-plasma and of osmotic pressure * equal to that of plasma should be irritating. Further, it is only asserted that gangrene resulted six times, though the solution was often used, and in the *experiments* where gangrene resulted the concentration of the soda used was much above .25 per cent.

However, since we know the importance of calcium and

* Dr. Francis C. Wood has frozen this solution for the writer and has found that its freezing point is very close to that of normal blood.

potassium in body fluids, and since no practical objections have been raised as in the case of the alkaline fluid, it would seem wise to use sodium, potassium, and calcium in our salt solution for routine use.

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TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting, March 23, 1904.

The President, HOWARD LILIENTHAL, M.D., in the Chair.

GUNSHOT WOUND OF THE INTESTINES.

DR. LEWIS A. STIMSON presented a man, twenty-two years old, who was admitted to the Hudson Street Hospital on January 2, 1904, about midnight, suffering from a penetrating gunshot wound of the abdomen, which he had received in a brawl shortly before the time of his admission. The point of entrance of the bullet was just above the tenth rib, a little to the outer side of the left mammary line. Ten hours after receipt of the injury, the abdomen was opened through a transverse incision, about six inches long, made close below and parallel to the twelfth rib on the left side. Upon exploring the track of the bullet, it was seen that the direction taken by the missile had been downward, backward, and inward. Blood-clots were found in the peritoneal cavity, and an examination of the intestines revealed a perforation of the descending colon near the splenic flexure. This involved all the coats of the gut, and was closed with interrupted silk and Lembert sutures. No other perforations were found. The point of exit of the bullet from the general abdominal cavity was found to be just adjacent to the lower pole of the left kidney, taking a course towards the deep spinal muscles, in which it had become embedded.

The peritoneal cavity was irrigated with normal salt solution; the peritoneum was brought together with continuous catgut

sutures, and the external wound closed, with drainage. The wound of entrance was packed with iodoform gauze.

In addition to his abdominal wound, a second bullet had inflicted a superficial wound over the sternum. The patient was discharged cured on February 5, 1904.

Dr. Stimson presented a second patient, a man, twenty-three years old, who was admitted to the Hudson Street Hospital on January 7, 1904, at 11.30 P.M., suffering from a gunshot wound which he had received in a quarrel a short time before his admission. The bullet had entered in the sacral region, half an inch to the left of the median line, and just above the intergluteal fissure. It had traversed the general abdominal cavity and could be felt under the skin on the right side, just above the inner end of Poupart's ligament.

The patient's general condition was good, and he was operated on about eleven hours after the receipt of the injury. A combined transverse and longitudinal incision, six inches long, was made anteriorly, its centre close above the symphysis pubis. Upon exploring the abdominal contents, the first perforation found was a single one in a loop of small intestine. This was closed in the usual manner. Two double perforations of the intestine were then found, evidently caused by the bullet passing through a knuckle of gut. Through the perforations in the gut, its greenish, spinach-like contents exuded freely, contaminating the abdominal cavity. After suturing the perforations, the abdominal cavity was sponged out and then flushed with normal saline solution. The wound was closed, with drainage. The posterior wound of entrance was drained with iodoform gauze, and the bullet was removed through a small anterior incision through the skin.

The patient made an uneventful recovery, and was discharged cured on February 5, 1904.

In reply to a question as to how thorough a search should be made for perforations in dealing with these cases, Dr. Stimson said he did not favor complete evisceration of the abdominal contents unless there were special indications demanding it. There was certainly an advantage in not eviscerating a patient, or exposing too much of the abdominal contents. He usually limited himself to an examination of the loops in the immediate neighborhood of the line traversed by the bullet, and he could not recall a case in which he had overlooked a perforation.

RECURRENT CARCINOMA OF PAROTID; LIGATION OF BOTH EXTERNAL CAROTIDS; EXCISION; X-RAY.

Dr. Benjamin T. Tilton presented a man of fifty-five years who two years ago first noticed a swelling in the left parotid region. This gradually grew larger, until it attained the size of an adult fist. It was very painful, became ulcerated, and bled easily.

About a year after its appearance he applied for relief at Bellevue Hospital, but the surgeon in charge of the division at that time evidently regarded the case as inoperable, and the patient was transferred to the Metropolitan Hospital on Blackwell's Island, where he was operated on in February, 1903. He left the hospital six months later (July, 1903), and at that time there was already a recurrence at the site of the operation about the size of a walnut.

On September 22 he was readmitted to Bellevue Hospital, and when Dr. Tilton first saw him at that time, the tumor had grown to the size of an orange. It was hard and ulcerated, and bled very readily. The pain it gave rise to was so severe that the patient could not sleep, and his general health had become much impaired. There was left facial palsy, which had followed the first operation.

Operation by Dr. Tilton, September 30, 1903. On account of the vascularity of the tumor, and also with the hope that it might assist in preventing a recurrence, both external carotids were tied as a preliminary step. A circular incision was then made around the growth, extending across the cheek and neck, upward through the lobule of the ear and posteriorly about an inch above the tip of the mastoid. After removing the growth as thoroughly as possible, the actual cautery was freely applied to any suspicious looking tissue that had to be left behind. The operation was almost bloodless. The extensive wound cavity that was left was allowed to granulate, and five weeks later the granulating surface was covered with skin-grafts taken from the patient's leg.

Subsequent to the operation, beginning on December 1, 1903, four applications of the X-rays were made, each of ten minutes' duration, with the idea of preventing any recurrence. On December 26, under cocaine anæsthesia, a slightly enlarged gland was removed from the neck in the region of the ligated external carotid. This was submitted to a pathologist, who pronounced it carcinoma. The pathological report on the original tumor had been mislaid,

but the malignancy of the growth was shown by the very rapid recurrence following the first excision at the Metropolitan Hospital.

Dr. Tilton said that six months had elapsed since his operation, and there were thus far no signs of a recurrence. He attributed this favorable outcome to the wide excision, the free use of the actual cautery, and the ligation of both carotids.

Dr. Stimson said the result was a very brilliant one, and inspired the surgeon with perhaps needed confidence in attacking such an unpromising case. He thought that while it was unfortunate that the report of the pathologist upon the character of the original tumor had been lost, the examination of the gland subsequently removed was sufficient, in addition to the history, to establish the character of the growth.

Dr. Willy Meyer said he thought that the free use of the Paquelin cautery was an important factor in the immunity from recurrence enjoyed by Dr. Tilton's patient. He recalled the case of an old man of seventy-five with a large, ulcerating carcinoma of the parotid which was so far advanced that a radical operation was inadvisable. In order to give the patient some relief, however, it was decided to remove as much of the growth as possible with the knife and sharp spoon, and after this was done the site of the growth was covered with small pledgets of cotton soaked in a 50 per cent. solution of chloride of zinc. These were left there for about a week and produced a far-reaching eschar. The patient did not have a recurrence for over a year after the operation, when he died from apoplexy.

FRACTURE OF THE SPINE.

Dr. Royal Whitman presented a man, thirty-five years old, who three years ago fell down the hold of a ship, striking on his spine. He was able to walk after the fall, but only with great difficulty. He was assisted to his home, and remained in bed for six weeks, suffering from pain and stiffness in the back. Subsequently, he applied for treatment at the Hospital for Ruptured and Crippled, and an examination at that time showed a distinct angular kyphosis of the spine, evidently due to forcible compression of one of the vertebral bodies in the lower dorsal region. A plaster-of-Paris jacket was applied, and the patient had since been able

to resume his work as a long-shoreman and was apparently in excellent health.

Dr. Whitman said he had seen a number of cases of this form of fracture of the spine, and in all of them a recovery had followed. The diagnosis was very important, because on account of the angular deformity that resulted, and the pain and stiffness, such a case might readily be mistaken for one of Pott's disease. He said, also, that many physicians were unwilling to admit that the spine might be fractured without more serious symptoms and consequences.

In reply to a question, Dr. Whitman said that paralysis had not followed the injury in this case.

Dr. Lilienthal said he thought it would be a very difficult thing to crush bones that were held apart by the elastic intervertebral disks; and it seemed to him that the partial crushing of two or more of these disks might cause just such a deformity as was present in the case shown by Dr. Whitman. He suggested that an X-ray picture might show the real state of affairs.

Dr. Whitman said it had actually been demonstrated that these bones were at times crushed. The deformity was so localized and angular that the crushing of the intervertebral disks would hardly account for it.

Dr. Stimson said that at the Hudson Street Hospital these cases of marked kyphosis, without apparent symptoms, were not infrequently seen. The lower dorsal or upper lumbar region was the part of the spine generally affected, and in the history of the cases marked ventroflexion was usually a factor in the production of the injury. The intervertebral disks probably became absorbed, so that the bodies of the affected vertebræ were sometimes found fused into one mass.

THE COMBINED TRANSVERSE AND LONGITUDINAL INCISION IN LAPAROTOMY.

Dr. Lewis A. Stimson read a paper with the above title, for which see page 178.

Dr. Charles L. Gibson said that in the limited number of cases in which he had had the opportunity to use this incision, the result had been very satisfactory. In all of them the chief factor that prompted him to resort to the method was the desire of the patient to get as good a cosmetic result as possible.

Dr. Tilton said he had used the combined transverse and longitudinal incision in twelve cases, seven of them double pyosalpinx, while the remaining five were cases of ventral fixation. In all of them the result was extremely satisfactory. At first he was rather appalled by the size of the space laid open for possible infection, but none had occurred in his experience. The method was especially favorable in ventral fixation, where the wide exposure gave ample opportunity for suturing the uterus to the recti muscles. The easy retraction of the parts was particularly noticeable in fat subjects. The scars that remained showed no tendency to broaden, and were extremely satisfactory in their ultimate appearance. The method became easier with practice, and the length of time it required was not much greater than that required for the usual incisions. The method deserves more general trial and is capable of more extensive application.

NEPHRECTOMY FOR TUMOR OF THE KIDNEY.

Dr. Frederick Kammerer presented a specimen, which was removed a few days ago from a child six years old. Very little could be learned regarding the past history of the case. When the patient was brought to St. Francis's Hospital, a large tumor was found, completely filling the left side of the abdomen in the region of the kidney. An incision was made parallel to the lower border of the ribs and extending from the spinal column forward to the median line, laying open the retroperitoneal space and at the same time opening the peritoneal cavity. The tumor had evidently started from the lower pole of the kidney, necessitating a nephrectomy.

VOLVULUS OF A PAROVARIAN CYST, WITH THE CORRESPONDING TUBE AND OVARY.

Dr. Kammerer presented a specimen removed from a young woman of twenty-three, with no previous history. About thirty-six hours before her admission to the hospital she had been seized with severe pains in the abdomen. Her temperature on admission was 102° F. There was a fluctuating tumor immediately above the symphysis. On opening the abdomen, this proved to be a parovarian cyst in a state of beginning gangrene. Together with the entire tube, the ovary, the infundibulopelvic and the broad liga-

ments, the cyst had been twisted to the extent of 180° to the left. There was a sharp line of demarcation running along the base of the broad ligament, ending on one side at the junction of the tube with the uterus, on the other at a point several inches beyond the reflection of the infundibulopelvic ligament. This necessitated a rather high ligation of the ovarian vessels.

Dr. Kammerer said that twists of a well-defined pedicle were of frequent occurrence in parovarian and dermoid cysts, but he thought that those involving the entire broad ligament were rather rare.

Stated Meeting, Wednesday, April 13, 1904.

The Vice-President, Dr. George Woolsey, in the Chair

RECURRENT VILLOUS CARCINOMA OF THE BLADDER.

Dr. Charles L. Gibson presented a man, sixty-three years old, who was operated on by Dr. Edward L. Keyes in 1891 for a "villous" tumor of the bladder which was removed by the suprapubic method. The patient made a perfect recovery, and was free from all bladder symptoms for a period of over ten years.

About two years ago he again began to suffer from intermittent hæmaturia, which increased in frequency and quantity, and was accompanied by more or less pain on urination. His general health was well maintained. After a preliminary cystoscopy, which distinctly revealed the outlines of at least one large tumor, the bladder was opened above the pubes by Dr. Gibson on February 16, and its cavity was found to be almost completely filled with multiple growths, some of them as large as an adult fist. Some of these tumors were partly soft and very vascular, and they were removed as thoroughly as possible with the scissors and Volkmann spoon. A rubber drain was inserted, the bladder was left open and packed with sterile gauze, for control of the hæmorrhage, which was allowed to remain for forty-eight hours. The tube was removed at the end of four weeks, and the wound had practically healed at the end of seven weeks. He has had no pain nor hæmaturia since the operation, and the frequency from which he suffered had also disappeared, so that he could now sleep nine hours with-

out getting up to urinate. A recent examination of the urine showed that it was normal in color and acidity, and contained neither albumen nor casts. The growths removed from the bladder were submitted to a pathologist, who reported them to be villous carcinoma. After the primary operation by Dr. Keyes, the tumors were described as villous papilloma.

In reply to a question as to what the ultimate prognosis was in a case of this character, Dr. Gibson said that in all the cases of villous growths of the bladder that he had been able to trace, the tumors had in the course of time undergone the so-called malignant degeneration, and the patients had either died or were dying, not from the growths themselves, but from cystitis or renal complications. In this particular case there would probably be a recurrence within a year or two. In a case upon which he operated some years ago, and removed a tumor that almost completely filled the bladder, the man made a perfect recovery, and was free from symptoms for a year afterwards.

Dr. Andrew J. McCosh said he had been unusually fortunate in his operations on this unsatisfactory class of cases. He recalled the case of a man of sixty years, a physician from out of town, upon whom he operated nearly two years ago, and removed an epithelioma about the size of a walnut from the base of the bladder. He had recently heard from the patient's son, also a physician, that his father was enjoying excellent health and was fully able to take care of his extensive practice. Another case was that of a woman, a school-teacher, about fifty years old, on whom he operated thirteen months ago, and removed the entire bladder, which was extensively involved by a malignant growth. An inch or more of each ureter was removed, and the ends left loose in the retroperitoneal tissue of the pelvis. Since the operation, the patient had gained over thirty pounds in weight, and was still able to do her work as a teacher in one of the public schools. She wears a tube, which enters the pelvis through the vaginal vault, and the urine drains into a urinal worn against the thigh.

In a third case, Dr. McCosh said, the operation for a malignant growth of the bladder was done fifteen months ago, the ureters being treated in the same manner, and the patient was still, apparently, enjoying good health. Probably in all of these cases a recurrence would take place sooner or later, but the operation had given the patients a period of comparative comfort.

Dr. F. Kammerer said that about three years ago he had shown a patient, the greater part of whose bladder had been removed for malignant disease; two and a half years after the operation a recurrence took place, the patient dying shortly afterwards. One interesting feature of the case was that, despite the fact that only a small section of the bladder was left, its lumen was gradually increased until the man was able to hold about 200 cubic centimetres of urine.

GASTRO-ENTEROSTOMY FOR SEVERE HÆMATEMESIS.

Dr. George E. Brewer presented a man, thirty-eight years old, a cab-driver, who was admitted to the Roosevelt Hospital in March, 1904, suffering from the effects of five severe attacks of hæmatemesis occurring within the previous five days. He gave a distinct history of gastric ulcer, extending over a period of several years. Of late, the pain after taking food had been very severe, and was almost invariably followed by vomiting a quantity of exceedingly sour fluid. The pain was located in the median line, about two inches above the umbilicus.

The first hæmorrhage came on spontaneously, without prodromal symptoms. The second occurred on the following day, when he vomited about one quart of dark, clotted blood. Three more hæmorrhages occurred in the next three days, which so prostrated him that he was unable to rise from his bed.

Upon his admission to the hospital, an examination of the blood showed 2,700,000 red cells, and 60 per cent. of hæmoglobin. His temperature was subnormal; pulse, 112. Under ether anæsthesia, a posterior gastro-enterostomy was performed with the Murphy button, the operation being completed in fourteen minutes. For three or four days following the operation he vomited small quantities of dark greenish fluid, but no fresh blood. The stools remained tarry in appearance for several days. The patient made a rapid recovery, and thus far there had been no return of the symptoms. The patient began to take food four days after the operation, and since then he had gained about twenty pounds in weight.

Dr. F. Kammerer referred to a case of malignant disease of the stomach in which there were repeated hæmorrhages, almost as severe and as sudden as those in the case reported by Dr. Brewer. The patient was in a most critical condition when posterior gastro-

enterostomy was done; but he recovered, had no further hæmorrhages, and lived for almost a year after operation.

Dr. Erdmann, who had seen the case in consultation before the patient's removal to the hospital, corroborated what had been said regarding the profuse character of the hæmorrhages, necessitating injections of morphine and strychnia and saline infusions.

Dr. William B. Coley said that three or four years ago he showed before the Surgical Society a case of profuse hæmorrhages resulting from a duodenal ulcer. A gastro-enterostomy was done, and the patient was still in good health. In another case of gastric ulcer, with severe hæmatemesis, the patient was well one year after the operation, when she was lost sight of.

INTRACRANIAL NEURECTOMY FOR FACIAL NEURALGIA.

Dr. Brewer presented a man, sixty-eight years of age, who had suffered for seven years from neuralgia in the second and third branches of the fifth nerve, on the left side. His sufferings had at times been intense. He had been under every kind of medical treatment without relief. For the past two years he had been under treatment at the Neurological Department of the Vanderbilt Clinic, and from there he was referred to the Roosevelt Hospital for operation on the ganglion.

As he had never experienced pain in the branches of the first division of the nerve, Dr. Brewer regarded the condition as due to a peripheral lesion rather than to disease of the Gasserian ganglion.

Under chloroform anæsthesia, the skull was opened as for the Hartley operation, the dura stripped from the base of the skull, and the foramina exposed. The second and third branches of the fifth nerve were then drawn upward with a blunt hook and severed close to the ganglion. A folded piece of rubber protective tissue was then introduced between the cut ends of the nerves and the foramina, and the wound closed in the usual manner. The patient made an uninterrupted recovery, and since the operation he had been entirely free from any recurrence of the pain.

Dr. Brewer said this was the third case upon which he had operated by this method, with entirely satisfactory results. In his first case, he was obliged to adopt the method as a make-shift; in that instance, an operation for the removal of the ganglion was

undertaken, but the hæmorrhage proved so severe that he had to abandon it.

Dr. Erdmann said he had removed the ganglion in three cases of inveterate facial neuralgia, and it was generally accepted that the seat of the trouble in this class of cases was in the ganglion, and not in the nerve-trunk.

Dr. Brewer said that in cases where the symptoms were distinctly limited to one or two branches of the fifth nerve, it was justifiable to assume that the lesion was not a central, but a peripheral one. The operation he had described was much less formidable than removal of the ganglion. Personally, he had always held the view that in the obstinate cases, where all three branches of the nerve were involved, the lesion was in the ganglion.

FRACTURE OF THE SPINE.

Dr. Royal Whitman presented a young woman who a year ago fell from a height of thirty feet. The only injury apparent at the time was a fracture of one leg, and after remaining in the hospital for six weeks she was discharged. She subsequently complained of pain and stiffness of the back, and an examination showed a marked angular deformity in the lower dorsal region of the spine, apparently resulting from a fracture of the vertebral bodies. A plaster-of-Paris jacket was applied, and the patient had entirely recovered so far as her symptoms were concerned, although the kyphosis still remained.

This case, Dr. Whitman said, was similar to the one he presented at the last meeting of the Society, and showed the comparative frequency of this form of compression fracture of the spine. It was often overlooked or unrecognized, but the diagnosis was important on account of its similarity to Pott's disease.

CLEFT PALATE.

Dr. Charles N. Dowd presented a child to illustrate the Brophy method of treating cleft palate in very young children. The cleft was a very wide one, running up into the nostril. The operation was done when the child was nine weeks old, and consisted in dividing the bone above the alveolar border, and then passing a silver wire through each of the alveolar processes and

drawing them together very firmly. The wire traction sutures were left in for three weeks, and then had to be removed, as the child developed scarlet fever. There was still quite a gap left in the palate, but at least half an inch had been gained by the operation.

Dr. Woolsey said he had tried the Brophy method in one case, that of a child perhaps six weeks old. In that instance he was enabled to bring the edges of the cleft together. The most difficult part of the operation was to pass the silver wires, as he had no suitable instrument at his command at the time for that purpose.

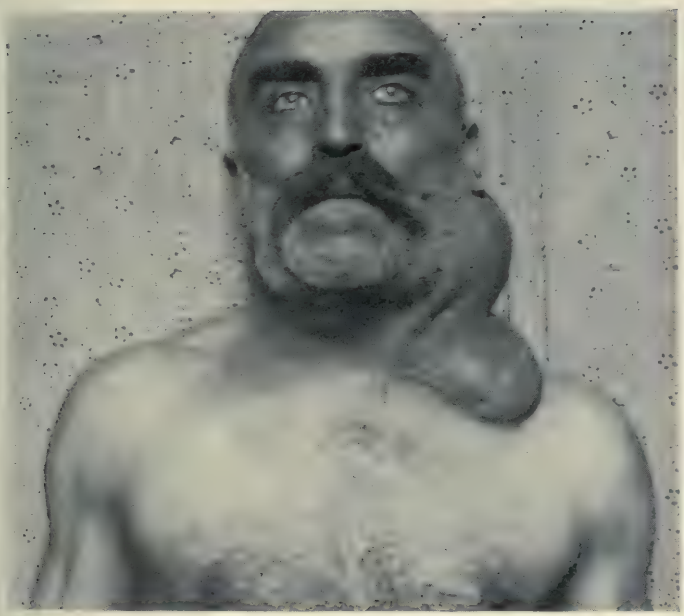
PERFORATING ULCER OF THE PYLORUS.

Dr. John F. Erdmann presented a young man of twenty-three years, who first came under his observation four weeks ago. The symptoms he complained of seemed to indicate trouble in the region of the appendix, but through an exploratory incision that organ was found to be normal. A second incision higher up was followed by a gush of fluid resembling thin pus, and a careful search revealed a perforation, about the size of a 22-caliber ball, in the pylorus. This was closed first with a purse-string, followed by Lembert suture. The abdominal cavity was thoroughly irrigated and closed without drainage. The patient's recovery was uncomplicated, and he had since remained well.

Dr. Erdmann said that of nine or ten cases of perforative ulcers of the stomach coming under his care, this was the first instance in which the patient gave a history of previous digestive disturbance. This patient stated that about two weeks before the occurrence of the perforation he had some pain in the region of the stomach, and that on one occasion he had vomited a small quantity of blood. On the day of the perforation he had drunk a large quantity of cold beer.

EXTENSIVE RECURRENT LYMPHOSARCOMA OF THE NECK

Dr. Forbes Hawkes presented a man, fifty-four years old, who had an attack of rheumatism about fourteen years ago. Following this, he noticed a swelling on the left side of the neck, which rapidly increased in size. About six years ago he came under the care of the late Dr. Van Arsdale, who did a very radical



Lymphosarcoma of neck. (Hawkes.)

operation, removing the entire growth. In the course of his operation he cut through the internal jugular vein and had to resect a portion of it. In the course of a few months the growth recurred, and had now attained a very large size. A number of the glands on the opposite side of the neck and also in the groins were involved. (See Figure.)

The patient, who refused to submit to a radical operation, was now being treated with injections of Coley's fluid. The pathologist's report in this case was that the growths were lymphosarcomata.

Dr. Brewer said the multiplicity of the lesions in this case, and their long duration, suggested Hodgkin's disease or some allied condition which had not yet reached the stage of profound anæmia. In Hodgkin's disease the lesions in the lymph nodes are often described as of sarcomatous nature, but they must not be regarded as identical with that exceedingly malignant and rapidly fatal form of disease called lymphosarcoma.

Dr. Kammerer said that the patient shown by Dr. Hawkes had been under the care of Dr. A. V. Moschcowitz, assistant surgeon to Mount Sinai Hospital, who had informed him that some of the growths had disappeared under the use of arsenic. The diagnosis of the case at that time was Hodgkin's disease.

Dr. William B. Coley said he did not think it was uncommon to find metastases in the groins and axillæ in a typical case of lymphosarcoma of the neck. He recalled a case that began as a typical round-celled sarcoma on one side of the neck, and then involved the opposite side, then both axillæ and both groins, and finally there was general metastases, there being hundreds of tumors throughout the skin. Repeated examinations in that case confirmed the diagnosis of round-celled sarcoma.

Dr. Kammerer said he did not agree with the statement made by Dr. Coley that cases of true lymphosarcoma with metastases in the lymphatic glands were not uncommon. These tumors developed in one gland, grew rapidly, and finally perforated the capsule of the gland, invading the surrounding tissues. They generally recurred after extirpation, and are not amenable to medical treatment (arsenic) as some cases of Hodgkin's disease. Ulcerations, pressure on the œsophagus, trachea, and metastatic deposits in the internal organs are the usual causes of death. General invasion of the lymphatic glands was in his experience very rare.

Dr. Coley, in modification of his former statement, said that, while such cases were perhaps not common, they were occasionally met with.

REMARKS ON SARCOMA.

Dr. Andrew J. McCosh read a paper with the above title, for which see page 161.

Dr. Coley said he wished to emphasize the statement made by the reader of the paper regarding the uncertainty of the microscopic findings in this class of cases. He recalled a case of a tumor of the parotid, followed by the development of two or three enlarged nodules behind the ear. One of these was taken out and examined by a leading pathologist of another city, and the surgeon in charge, relying upon this report that the growth was not malignant, advised against operation. The patient was put on potassium iodide, and after two months' treatment he developed metastases in the abdominal wall, with evidences of internal generalization. One of the growths in the abdomen was subsequently removed, and proved to be a rapidly growing round-celled sarcoma. In another case, seen a year ago, there was a small tumor of the cheek that seemed to be composed purely of fibrous tissue, and the pathologist reported that fibrous tissue so largely predominated, that the growth was of a very low grade of malignancy, if malignant at all. In spite of this favorable outlook, the tumor spread in all directions, metastases rapidly developed and proved fatal within four months.

As to the question of resecting long bones, or amputating through the joint, Dr. Coley said that depended largely upon what bone we had to deal with. In cases of sarcoma of the femur, he thought it was better to amputate at the hip-joint. In dealing with a periosteal sarcoma of the femur, no operation could be too radical. In dealing with malignant growths involving the tibia, however, such a radical operation might not be necessary.

The use of the erysipelas toxins, Dr. Coley said, should be limited to the inoperable cases, or to cases after primary operation as a prophylactic measure against recurrence. Of the cases in which he had employed the toxins, twenty-four had remained well for from two to eleven years; twenty-one from three to eleven years, and sixteen from five to eleven years. Four were of the round-celled variety, and three of them were inoperable sarcomas

of the parotid. Under X-ray treatment the speaker said he had seen a number of sarcomas disappear, but they rapidly recurred, usually within a few months; all of them in less than a year.

Dr. Robert H. M. Dawbarn said that he would limit his remarks to a field not touched upon by the speaker of the evening, —the treatment of the region fed by the external carotid, by starvation of the malignant growths, in cases too far advanced to be extirpated. Dr. McCosh's excellent personal statistics in this region evidently refer only to cases not far advanced.

In Dr. Dawbarn's published essay upon this topic are given in detail more than fifty personal starvation operations,—a list long enough to enable one to reach certain conclusions. Chief of these is the striking difference in the value of the starvation plan as between cancer and sarcoma. In the former, no cases of permanent checking of the inoperable growth can be claimed. All who survived the operation done for carcinoma were temporarily checked, but such gain in longevity was only a few weeks to months. In sarcoma, however, the picture is much more favorable. Several cases are there recorded in full, in whom the shrunken growth has remained inactive for several years after the extirpation of the external carotids, and these cases remain shrunken; among them two of round-celled sarcoma, subperiosteal, of the lower jaw,—a type considered especially hopeless by Batlin in his work on "Malignancy." And in no case has a tumor been classed as malignant by the speaker except upon the evidence of an expert pathologist.

Dr. Dawbarn said that nearly a dozen members of this surgical society have now tried the starvation plan; but with a single exception these cases have all been carcinoma, not sarcoma. And apparently the failure to be of permanent benefit has discouraged these operators. In fairness to this new plan, it should certainly be tested in sarcoma; and the speaker asked for such tests and their results; remembering, however, that in a growth close to the orbit nothing favorable can be expected by starvation because of the free anastomosis there from the internal carotid.

In the one exception just alluded to,—an operation performed on a child at St. Luke's by a member of the Society,—the case has remained cured; and the pathologist pronounced the tumor sarcoma. But the operator, from its gross appearance, doubted its

being of this nature; hence Dr. Dawbarn has not claimed it as a sarcoma permanently checked.

Remembering the fact that carcinoma spreads through the lymphatic system, sarcoma through the arterial channels, mainly, one can readily comprehend why this starvation plan should prove much more hopeful in the latter type of malignant growth than in the former.

Dr. Woolsey said he could corroborate what had been said regarding the difficulty of classifying tumors of the endothelial variety, both as to the group they belong to and as to their malignancy or non-malignancy. In a case of recurrent endothelioma of the parotid gland upon which he had operated nearly four years ago, and which he presented to the Society about a year ago, there were no signs of a recurrence up to the present time. Dr. James Ewing, who examined the tumor, stated at the time that he had not seen any other recurrent endotheliomata. In another case of tumor of the spinal cord which he removed a little over a year ago, the growth was pronounced by one pathologist a sarcoma of an indeterminate variety, and by another an endothelioma. Thus far there were no signs of a recurrence As a class, Dr. Woolsey said, endothelial tumors seemed to be comparatively benign. The malignant changes that sometimes occur in fibromata were exceedingly important, and he could recall instances where the pathologist's report gave some indication that such changes were not unlikely to occur.

In connection with the question of choosing between excision and amputation in dealing with malignant disease involving one of the long bones, Dr. Woolsey referred to the case presented at a recent meeting of the Society by Dr. L. A. Stimson, where he had excised the upper end of the affected humerus, and left a comparatively useful arm. Such a procedure, however, could not be followed in the lower extremity.

RETROPHARYNGEAL SARCOMA.

Dr. Charles H. Peck presented a specimen removed from a woman, thirty-one years old, who was admitted to Roosevelt Hospital on March 2, 1904. She was married and had borne three children; no miscarriages. With the exception of an attack of

mumps in childhood, her past history was unimportant, and she had always been strong and healthy.

About eight years ago, the patient noticed that her tongue was at times swollen, especially after talking; this swelling was only temporary in character and was not accompanied by soreness. About a year after the onset of this phenomenon the patient noticed a swelling about the size of a hickory-nut on the inner wall of the left side of the pharynx. This gradually increased in size, and in the course of two years the external tissues of the neck had become invaded. There was considerable dysphagia, and occasional neuralgic pains in the side of the neck and face. There was no tenderness on pressure

At the time of the patient's admission to the hospital, an examination showed a large, globular mass on the left side of the neck, extending from the angle of the jaw to behind the ear. It was about the size of an apple, perfectly smooth and very tense. The mass was beneath the sternomastoid muscle and behind the masseter. The skin covering it was movable, and not reddened or tender. The carotid and facial arteries could be felt pulsate external to the mass.

Inspection of the throat showed a firm, smooth, rounded tumor involving almost the entire posterior pharynx. There was no facial paralysis; the orbit was not involved. Upon pressing the external growth, the internal one was observed to grow in size.

Operation, March 5, 1904, by Dr. Robert F. Weir. An incision, four inches long, was made over the tumor. It was found to be well encapsulated, and by blunt dissection it was freed from its bed and removed. The patient made an uneventful recovery, and left the hospital two weeks after the operation. The growth was submitted to Dr. Hodenpyl, who pronounced it a small spindle-celled sarcoma, showing evidences of marked degeneration.

RUPTURED BLADDER.

Dr. F. Tilden Brown showed a bladder with a rupture in its posterior wall. This patient entered the hospital three days after the occurrence of the rupture. One interesting feature of the case was that, upon injecting the bladder with fluid, the exact quantity thrown in was returned. This was subsequently found to be due to the fact that the defect in the bladder wall had become sealed by adhesions. The patient died from general peritonitis.

INTESTINAL FORCEPS.

Dr. John D. Rushmore exhibited a forceps that he had devised for the purpose of facilitating the insertion of the Murphy button. He made the suggestion that the button could be more easily introduced partially closed than having each half introduced separately. The forceps is devised to accomplish this object. The smooth halves of the button in contact with the mucous membrane are sometimes quite insecure under the pressure of the thumb and finger when they are forced down against the purse-string suture with a pressure unsafe for the suture.

The instrument (made by Tiemann & Co., New York) consists simply of blades ending in sections of a circle to grasp the largest button. The circular ends are one-eighth inch wide, and leave room in the partly closed button for tightening the purse-string suture. A catch on the handle renders the instrument secure, and after each purse-string suture has been tied, the forceps can be easily removed and the button completely closed.

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting, April 4, 1904.

The President, HENRY R. WHARTON, M.D., in the Chair.

SEPARATION OF THE QUADRICEPS EXTENSOR FEMORIS TENDON FROM THE PATELLA.

DR. HENRY R. WHARTON presented a man, fifty-one years of age, who fell while walking and injured his right knee. He was unable to walk after the accident, and was treated for some weeks at his home; the nature of the treatment he received is not known. He applied for treatment at the Surgical Dispensary of the Presbyterian Hospital six weeks after the injury, and was referred to the Surgical ward.

Admitted to Surgical ward, May 29, 1903. Examination showed that he walked with difficulty, owing to weakness and loss of extension of the right knee-joint. It was found upon careful examination that there was complete loss of extension of the right knee, and a gap existed in the tissues just above the patella, due to a separation of the quadriceps extensor femoris tendon from the patella.

After the patient was anæsthetized, a longitudinal incision was made from the centre of the patella, which extended up the thigh for four inches. The upper portion of the patella and the lower portion of the quadriceps extensor tendon were exposed, and it was discovered that the injury was not merely a rupture of the tendon, but that the fibrous capsule of the patella over its upper surface had been torn off and drawn upward with the tendon, and that the lower portion of the capsule was separated from the bone by a layer of partially organized blood-clot and blood-

stained synovial fluid. The knee-joint also contained a considerable amount of blood-clot.

All blood-clots were removed from the joint and from the surface of the patella; to accomplish the latter object, it was necessary to curette the upper surface of the patella. The lower portion of the capsule attached to the patella was sutured to the bone by drilling the patella at the edges and in the centre, and passing chromicized catgut sutures through the capsule and drill-holes. The upper end of the patella was next drilled, and a heavy silver wire suture was passed through the lower portion of the tendon and through the drill-hole in the patella, and when this was secured the tendon was brought down in contact with the patella. It was considered wiser to drill the patella and use a heavy wire suture to secure the tendon to the bone, rather than to trust to sutures passed through the capsule, as the line of separation was irregular, and the edges of the capsular tissues were very much frayed. Portions of the capsule adherent to the tendon were next sutured to the lower portion of the capsule by a number of chromicized catgut sutures. The fascia was then brought together by a number of chromicized catgut sutures, and the skin and superficial tissues by a second layer of sutures. The wound was dressed with a sterilized gauze dressing, and the knee-joint fixed by a plaster-of-Paris bandage, including the foot and thigh.

The patient did well after the operation. The bandage was trapped on the twelfth day and the sutures removed, as the wound was found healed.

The fixation dressing was retained for six weeks, and after this time the patient was allowed to go about on crutches. He was discharged from the hospital, August 11, 1904, at which time the attachment of the tendon to the patella seemed to be firm, and he was regaining the motion of extension of the knee-joint.

At the present time he walks well and has fair extension of the knee-joint.

Dr. Wharton added that at a meeting of the Academy last year he reported a somewhat similar case, in which the patient had suffered from a simultaneous rupture of both quadriceps extensor tendons, in whom, six weeks after the injury, he exposed the seats of rupture of the tendons and sutured them, and the patient recovered with absolute restoration of function.

GALACTOCELE.

Dr. W. W. Keen presented a woman, aged twenty-one years, who was admitted to the Jefferson Medical College Hospital December 14, 1903. She had had a lump in her left breast almost as long as she can remember, and believes that it began about the time that her menstruation was first established at twelve to thirteen years of age. At first it was only about the size of a lady apple. She was confined March 8, 1903. When she was about three months pregnant, the tumor began to grow. At the time of her confinement, it was about twice as large as at the present time. After her confinement the tumor began slowly to shrink. The breast contained milk after her confinement, but the nipple was flat and retracted, and she did not nurse the child from that side.

When admitted to the hospital, the tumor occupied more than one-half of the left breast, involving all of the inner lower quadrant and parts of the two adjacent quadrants. It was ten centimetres in diameter, was rather firm, markedly lobulated, elastic, not attached either to the chest-wall or the skin. Apparently, the skin, however, is attached to the septa dividing the lobules. The nipple is flat but not retracted; milk can be expressed from the nipple. There are no glands perceptible in the axilla or neck. The urine is normal.

December 16 an elliptical incision was made, through which the entire breast was removed, but nothing more. The skin over part of it was so thin that, in spite of the utmost care, two of the smaller cysts were opened and their rich, creamy semifluid contents was discharged. A culture was taken from it, and the breast also was sent to Professor Coplin for examination. After its removal, it was found by section that the major part of it was one large galactocele with a number of subsidiary cysts.

She made a perfectly smooth recovery, her highest temperature being 99.4° F. She was discharged one week after the operation with the wound entirely healed.

Practically the entire mammary gland was involved in the cystic change, the largest cyst being about six centimetres in diameter; many others being one or two centimetres. Examination of the milky fluid, which in some of the cysts was quite thick and creamy, showed it to be made up almost wholly of globules of fat, which gave the characteristic reaction of that substance with Sudan iii.

Professor Coplin and Dr. Ellis, by whom the specimen was examined, report that the microscopical appearances of the tumor after embedding and staining the sections with hæmatoxylin and eosin, hæmatoxylin and Van Gieson, Mallory's reticulum stain, toluidin blue and Weigert's elastic tissue stain, show some increase of the inter- and intra-lobular fibrous tissue, though this is not at all a prominent feature of the specimen. The most conspicuous change in the stroma is a marked periacinous infiltration of mononuclear cells, practically all of which are of the small, round variety. Similar, but less extensive accumulations are present around the ducts. Many of the acini and ducts show marked distention, several of the former having in certain instances coalesced to form cysts, some of which are of large size. These cysts are lined by one or several layers of cuboidal or slightly flattened cells and possess a fibrous wall which in many instances is quite thick. Some of the cysts are partially filled by large cells having a more or less deeply stained periphery, the interior of which is made up of granular material containing numerous small, transparent, circular areas that are apparently fat globules. In some of these cells the granules predominate, in others the fat globules are more numerous. Nuclei are present in some, being flattened and peripherally placed in those cells containing most fat. In addition to the distinct cells are large masses of débris evidently resulting from cell fragmentation. In some of the cysts there is distinct evidence that these large cells are in process of formation from the lining cells which increase in size, become globular, and finally show within them the presence of fat.

Sections stained for elastic tissue show no evident increase in that tissue, though there is possibly some splitting of the elastic laminæ of the blood-vessels.

To the diagnosis of galactocele, Dr. Ellis, who made the examination, added "acute non-suppurative interstitial mastitis; slight chronic productive mastitis."

Dr. Keen said that he had reported this case of galactocele, because in his experience it was extremely rare. He had amputated the breast fully 500 times in addition to seeing a large number of cases, probably 300 to 500 more, in which no operation had been done. This, so far as he remembered, was the only case of galactocele that he had ever seen among these 800 to 1000 cases.

Almost all writers declare it to be rare; indeed, it is so rare

that in some cases he had found practically nothing beyond a bare mention of it.

As to the pathology, Ziegler ("Special Pathological Anatomy," American edition from the eighth German edition by MacAlister and Cattell, 1897, Section xiii, p. 1100) says, "When one of the ducts of a milk-secreting breast is occluded or partially obliterated by some previous disease, the part of the duct behind the obstruction occasionally but not very frequently dilates into a milk-containing cyst, known as a milk-cyst or galactocele. It does not usually lead to inflammation of the surrounding tissue; but in some cases changes take place in the milk, and these excite inflammation and proliferation in the fibrous stroma. According to Küstner, the mammary tissue may even soften and break down into pulpy detritus from such inflammation."

Sometimes they are attributed to injury. Much more commonly they begin soon after confinement during lactation.

Dennis, in his "Text-Book of Surgery," quotes a case by Atlee which began sixteen months *before* the patient's confinement, and another from Bouchacourt, which began twenty-four years after her last confinement. Each of these cases clearly began independently of normal lactation. In the present case it seems probably to have had some connection with the tumor which developed at the time when menstruation first began, when she was twelve or thirteen years of age, and therefore about six or seven years before her present pregnancy. It is to be noted that a year after her marriage, she had a miscarriage at two and one-half months. She did not notice that that pregnancy had any effect upon the tumor, very probably because it was terminated by accident before the breasts became functionally active. She is an unusually intelligent colored woman and gave a very clear history.

The symptoms and diagnosis can be practically considered together. The appearance of the tumor is usually rather sudden, usually soon after parturition, or at least during lactation, without any inflammatory changes, and with only the pain and discomfort incident to the tension and weight. Some of these tumors become excessively large. Scarpa reports one in a patient just the same age as the one reported which occurred ten days after her confinement and from which ten pounds of milk were evacuated. Milk was demonstrated to be present in the breast of the present case by pressure upon the tumor, which caused the milk to escape from the nipple.

The tumor often varies in size, as was indicated in the present case. She stated that at the time of her confinement the tumor was twice as large as when she was admitted to the hospital. It had slowly shrunk after her confinement, doubtless from the absorption of the watery part of the milk.

The contents of such tumors varies extremely: sometimes it is like simple human milk; sometimes, when the watery parts have been absorbed, it is changed, as in this case, to an extremely rich cream almost as thick as castor oil. Gross states that they may be filled with what appears to be pure oil which coagulated into a substance resembling lard, intermixed with crystals of margarine. In other cases the contents are like butter or cheese. In other words, all or any of the various products from milk may be present.

As to treatment, sometimes aspiration or drainage is recommended. No tumor so large as the present one, and with so many independent cysts, could by any possibility have been treated by either of these means successfully. Moreover, as was seen by the more minute microscopical examination of Dr. Ellis, the entire breast was permeated with these cysts even in those parts which were not visibly enlarged. The determination, therefore, to treat it by amputation of the entire breast seems to be amply justified. If a galactocele is incised and drained, especially if this is done during lactation instead of waiting until lactation is terminated, it is very apt to result in a milky fistula, or, if by any possibility infection takes place, an abscess of the breast develops.

Dr. William L. Rodman said he had seen but one case of lacteal cyst, which occurred in a married white woman of twenty-five years. This case differed from the one reported by Dr. Keen, inasmuch as the patient had never borne children, and, so far as known, had never been pregnant. Instead of there being a single cyst, there were multiple cysts; some very small, others as large as a small walnut. The upper and outer quadrant of the breast was chiefly involved. Microscopic examination by Dr. McFarland showed that the tissue surrounding the cysts was the site of a marked interstitial mastitis. Before operation, the masses were so hard that the diagnosis of multiple fibromata was made. Removal of the entire breast was insisted upon and performed. Incision of the breast after removal showed the presence of milk, and no surprise was occasioned by the pathologist's report of galactocele.

These cases are exceedingly rare, particularly in persons who have never been pregnant. They usually take the form of a single globular swelling behind the areola, due to the dilatation of a duct. Dr. Rodman agreed with Dr. Keen that the removal of the entire breast is the proper treatment in such cases as he had. Aspiration or even partial removal is not at all satisfactory in multiple cysts.

GASTROPLICATION FOR DILATATION OF THE STOMACH.

Dr. W. W. Keen reported the history of a man, aged thirty-one years, who was admitted to the Jefferson Medical College Hospital at the instance of Dr. Dunn, of Clifton Heights, Pa., on April 6, 1900. His father died of pneumonia at fifty-three; his mother and one sister are living and well; two sisters are suffering from pulmonary tuberculosis; his paternal grandmother died of cancer of the breast. He has never had any serious illness since childhood. He has used alcohol and tobacco in moderation. He states that he has had a weak stomach all his life, and for over a year has had a burning pain in the stomach below the ensiform cartilage, somewhat to the left of the middle line. Soon after taking food, the stomach becomes very sore, and the contents are often regurgitated into the mouth. He only vomits when the acidity becomes very great, and this is usually three to four hours after taking food. He has never vomited any blood. The gastric pain is not affected either by the taking of food or the vomiting of the food. He never remembers vomiting any food eaten one or more days prior to vomiting. A year and a half ago he weighed 210 pounds, his present weight is 180 pounds. His appetite is good, his bowels are habitually constipated, so that very often he does not have a stool for nearly a week. He has at times noticed dark material in the fæces.

Urine clear, amber, 1022, acid, no albumen or sugar, urea 2.3 per cent. Heart, lungs, and the abdominal viscera were normal, excepting the stomach, which is markedly dilated.

Three days after he entered the hospital his stomach was washed out with sterile water; the contents were not offensive. A test meal was then given and free HCl found, but no lactic acid. On the next day, four pints of sterile water were introduced into the stomach before he complained of discomfort. After the stomach was emptied of the water, eighty-four ounces of air were

introduced through the stomach-tube before he complained of discomfort.

The greater curvature of the stomach lies a handbreadth below the umbilicus.

Operation, April 11, 1900. A vertical incision was made, three centimetres to the left of the middle line; the stomach was drawn out and found greatly dilated. A forefinger was easily passed through the pylorus by invaginating the wall of the stomach. The stomach was then folded on itself by three rows of continuous Lembert sutures of silk, the last row of sutures bringing the greater curvature nearly up to the lesser curvature. The abdomen was then closed.

His highest temperature after the operation was 99.6° F. He was discharged from the hospital, May 3, in excellent condition. He could then eat food without regurgitating it, and the pain which he had noticed before the operation had entirely disappeared.

On account of an accident, he reported at the hospital again on February 25, 1904, nearly four years after the operation. His stomach has never given him the least trouble since the operation.

Dr. Keen remarked that the operation of gastroplication was of very recent origin. The first paper was by Bircher (*Correspondenzblatt für Schweizer Aerzte,* 1891, p. 713), and in this country independently by Weir (*Transactions of the American Surgical Association,* 1892, p. 149). This makes it desirable that we should know definitely the remote rather than the recent results of operation. Recovery, of course, by modern surgical methods is practically assured; but whether the operation will benefit the patient is quite another matter; hence he was glad, after the lapse of four years in this case, to report the final success of the operation in relieving the patient from all his discomfort.

Dr. William L. Rodman believes that the so-called cases of atonic or myasthenic dilatation of the stomach are rare; very generally, mechanical obstruction at or near the pylorus is the etiologic factor. The operation of gastroplication has a distinct field, but modern research has made this a more restricted field than even five years ago. The case reported by Dr. Keen indicates that the operation was not only indicated, but completely successful in every way. Dr. Rodman believes that Moynihan's is perhaps the best method for performing gastroplication.

Dr. Le Conte said that on purely theoretic grounds the operation of gastroplication did not appeal to him as a reasonable mechanical procedure. When dilatation of the stomach exists without pyloric obstruction, it is due to gastroptosis with accompanying atony of the stomach wall; in other words, the gastroptosis preventing the complete emptying of the stomach, the food retained produced the atony of the stomach wall. Under such circumstances the dilatation would affect equally the anterior and posterior walls of the viscus. By gastroplication the anterior wall of the stomach is alone reefed up, lessening, to be sure, the size of its cavity, and at the same time bringing the greater curvature nearer to the lesser; but the posterior wall is not dealt with, and the dependent portion of the stomach is simply changed from the greater curvature to some point on the posterior wall. The case which Dr. Keen has reported shows that such an operation is sometimes followed by most excellent results; but it would seem to the speaker that the dilated and thin posterior wall would remain as a constant menace for the reproduction of the symptoms. To the speaker's mind, the ideal mechanical procedure would be to drain the most dependent portion of the stomach by a posterior gastro-enterostomy, in this way placing the organ at rest and permitting the muscular fibres of the wall to regain their tone. Gastroplication only in part overcomes the mechanical condition present. It decreases to a certain degree the size of the stomach, and at the same time elevates it slightly, but it does not place it at rest or increase the opportunity for development of its muscular fibres.

Dr. John H. Gibbon said he had assisted Dr. Keen in the case of gastroplication reported, and, though they expected to find obstruction at the pylorus, careful search revealed none. In cases of atonic dilatation the stomach increases in size because it is unable to empty itself; gastroplication relieves the condition by securing drainage. Such a large percentage of cases, however, are due to irritation, if not actual ulceration and obstruction, at the pylorus, that gastro-enterostomy is the operation of choice in most cases. For performing this operation, Dr. Gibbon has in three cases used the Doyen clamps with very satisfactory results. With these appliances, posterior gastro-enterostomy can be performed very rapidly; in his first case the entire operation occupied but thirty-five minutes.

Dr. Keen, in closing, said that absolutely no obstruction was

present in the case reported, the dilatation apparently being due to weakness of the muscular coat of the stomach. He did not understand the objection of Dr. Le Conte to gastroplication; that operation reduces the size of the stomach, shortening both walls of the organ. In some reported instances only one row of sutures has been applied at the junction of the greater and the lesser curvatures. He believes that the employment of three rows, the upper (and last) one at the lesser curvature, is better technique. The whole question regarding the value of the operation in the case reported is one of fact; the result, so far as relief of the patient is concerned, could not be better. This is the only instance in which Dr. Keen has employed gastroplication. In reply to a question by Dr. Roberts, Dr. Keen said that he did not know what change occurred in the mucous membrane of the part of the stomach that was turned up. Replying to Dr. Taylor's question as to whether he would at the present time perform gastroplication or gastro-enterostomy for dilatation of the stomach, Dr. Keen stated that he would employ the former method in case of dilatation not due to pyloric obstruction (Keen: Cartwright Lectures on the Surgery of the Stomach, *Philadelphia Medical Journal,* 1898, Vol. i). His attitude towards gastroplication is largely due to the success of the operation in the case reported, as the entire number of cases on record is not large. In the Cartwright Lectures in 1898 he had collected fifteen cases with one death. In cases of dilatation of the stomach due to obstruction he would not use gastroplication, but would employ either Finney's method of gastro-duodenostomy or posterior gastro-enterostomy.

A NEW METAL ANASTOMOSIS BUTTON BY JABOULAY, OF LYONS.

Dr. W. W. Keen exhibited specimens of Jaboulay's modification of the Murphy button. Dr. Keen believes that in two respects it is an improvement on the original: 1. The weight is considerably diminished; 2. Of equal or even greater importance is the fact that the caliber is decidedly increased. In buttons of the same external dimensions the Murphy pattern has a caliber of one centimetre, the Jaboulay of one and one-half centimetres. This, of course, greatly increases the carrying capacity of the appliance.



FIG. 1.—Fracture of metacarpal and subluxation. From boxing. Right.

SUBLUXATION AND FRACTURE AFFECTING CARPOMETACARPAL JOINT.

Dr. George Erety Shoemaker said that, five weeks after injury, a young man applied on account of a painful condition of the right thumb, due to an injury which had been produced in boxing with gloves by catching the point of the thumb. The carpometacarpal joint was partly dislocated, and on being reduced by pressure immediately assumed its faulty condition. There was a mild arthritis present with swelling and redness. Treatment had been neglected, and the joint had become exquisitely painful as a result. There was obscure joint crepitus on manipulation, but no bone crepitus. Use of the part in writing had become very painful and was followed by prolonged aching. The presence of fracture could only be proven by the X-ray, which demonstrated chipping off of a sharp longitudinal fragment five-sixteenths of an inch long from the inner edge of the condyle of the metacarpal bone. (Fig. 1.) The fragment was evidently within the capsule, and probably could have been adjusted by manipulation, or held in place by a dressing, if it had been seen soon after the injury. Treatment was directed to relief of the arthritis present and slow recovery ensued, though, owing to the interval before beginning treatment, splinting and strapping did not hold the fragment. For several months the joint was likely to become painful if used much. An X-ray photograph was taken eight months later, which showed the fragment still separated. Absorption no doubt would be the ultimate result. The condition of subluxation of this joint is one which is familiar to boxers. When, as in this case, chipping of the side of the bone has occurred, the joint is likely to be permanently weakened, as far as liability to repetition of luxation or subluxation is concerned.

In this case the same joint had been twice before injured slightly, but complete recovery from symptoms had taken place. The element of fracture was evidently a new one, as the angles of the fragment were very sharp. Though obscure bony crepitus might have been obtained soon after the injury, this is an instance in which the true condition would be impossible of demonstration without the X-ray.

FRACTURE OF THE LOWER END OF THE RADIUS.

Thin plate split from posterior surface into radiocarpal joint.

DR. SHOEMAKER presented an X-ray photograph, saying that it represented the left carpus of a woman aged forty-two. The injury resulted from a fall upon the hand. (Fig. 2.) There was severe pain at the wrist-joint, but no deformity and no crepitus. According to the photograph, a rectangular thin plate of bone in size approximately a half-inch by one inch has been chipped or split from the posterior surface of the lower end of the radius, and displaced by sliding about two lines towards the ulna, and the same distance upward. The fracture extends into the joint.

There was no transverse fracture, no silver-fork deformity; and firmly grasping the lower end of the radius while an attempt was made to move the upper fragment gave no crepitus and no preternatural mobility.

This fracture appears to differ from the rare Barton's fracture in that the smaller fragment consists of a thin layer of bone only, having the same width as the head of the radius. The thin character of the fragment is demonstrated not only by its translucent appearance in the photograph here shown, but by a second photograph taken three months later (Fig. 3), which showed no trace of the fragment where it had slid over towards the ulna. Absorption had apparently taken place. Recovery was accomplished with good motion, though pain was persistently present during the earlier weeks, probably due to the joint injury.

DR. GEORGE G. ROSS said that systematic X-ray examination of all injuries involving the joints is made at the German Hospital. Upward of 2500 are now on record, 1500 of which have been reported. Dr. Ross believes that the older ideas regarding the nature of sprains should be revised, as in the great majority of instances spicules of bone are torn off, converting the injury into a sprain-fracture. For this reason sprains should be treated as fractures. This method is employed at the German Hospital, and results in recovery without excessive callus formation and persistent pain, which are sequels of many cases treated only as ordinary sprains. A second point emphasized by Dr. Ross was that among the 1500 cases previously reported there were fifty-two of primary fracture of the carpal bones and a number of the tarsal bones. In his recent work, Scudder states that the scaphoid and



FIG. 2.—Fracture of left radius.



FIG. 3.—Three months after injury.

semilunar bones have each two centres of ossification. Dr. Ross does not agree with this statement, as special efforts have been made to determine that point; skiagraphs from both sides have been made in all cases of injury, and also in healthy children, and double points of ossification have not been found. Dr. Ross, in conclusion, urged the importance of systematically X-raying all cases of sprain.

Dr. W. W. Keen said there was a great deal of truth in the remarks of Dr. Ross, though he had not observed that fractures accompanied sprains so frequently as was stated. He mentioned a case of sprain-fracture of the inner malleolus of the tibia that could not have been diagnosticated by palpation (*Philadelphia Medical Times,* April, 1871); the fracture was discovered after the leg had been amputated because of other wounds. Dr. Keen believed that Mr. Callender first used the term "sprain-fratcure."

DISLOCATION OF SEMILUNAR CARTILAGE.

Dr. W. W. Keen made a verbal report of this case. The patient was a young man of twenty, who, while playing basket-ball two and one-half weeks previously, had wrenched his left knee; since that time he could not straighten his leg beyond an angle of 135 degrees. Examination revealed marked tenderness over the internal interarticular fibrocartilage, and the joint was hot and painful. There was no effusion into the joint and no irregularity of the bones. The patient was anæsthetized with chloride of ethyl and attempts made to straighten the leg. Twice this was unsuccessful, but each time adhesions gave way. On the third attempt, reposition of the cartilage and the femur was felt, and the "snap" was distinctly heard. The leg could then be flexed and extended in a perfectly normal manner. This case is interesting because of the readiness with which the dislocation was reduced two and one-half weeks after injury. In this respect it was a rather unusual experience. [A week later the patient was seen and the knee was entirely well.]

GASTRO-ENTEROSTOMY FOR CARCINOMA INVOLVING THE STOMACH, OBSTRUCTING THE PYLORUS.

Dr. Alfred C. Wood exhibited a specimen showing the result of a gastro-enterostomy sixty-eight days after the operation.

The patient was a man, aged forty-nine years, widower, white, blacksmith, born in Ireland. (University Hospital, No. 2377.)

His father, mother, one sister, and four brothers are living and well.

The patient's medical history was as follows: He had had measles, chicken-pox, and typhoid fever. For the past ten years he had suffered from dyspepsia and flatulence, which were frequently so bad that he could not sleep at night. About eight months ago his dyspepsia was distinctly worse and marked tympanites developed. He vomited his food frequently. About this time blood was frequently observed in the matter vomited and also in the stools. The abdominal distress became a severe pain, which was always aggravated by taking food. The symptoms gradually became more pronounced until about two weeks ago, when he began to vomit everything he ate. He has slept but little at night and is much reduced in weight. About twelve weeks ago he had hæmorrhages from both the stomach and bowel which lasted over a period of two weeks; during this time there were three profuse hæmorrhages. He had been six weeks and four days in another hospital in this city, having entered about the middle of May.

The man was exhausted to the last degree from the repeated hæmorrhages and his inability to retain any food. He was so feeble when he entered the University Hospital that walking required a distinct effort.

Examination of the heart, lungs, and kidneys did not show any gross lesions. The abdomen was scaphoid except in the epigastrium and upper part of the umbilical region, where there was a large mass that could be seen even from a distance. The long axis of the mass was transverse, the breadth being three or four inches and the length nearly twice as much. It was moderately tender on pressure.

August 8, posterior gastro-enterostomy after the method of von Hacker was performed, a medium size Murphy button being employed to economize time. A few Lembert sutures were added to make the union more secure. An entero-anastomosis was not performed. The wound was closed by through-and-through sutures.

The progress of the case after operation was all that could have been desired. Peptonized milk was allowed on the second day on account of the exhausted condition of the patient. On the

eighth day solid food was given, and a few days later the full ward diet was permitted, the appetite being very good. There was but a single attack of vomiting from the time of operation until the end; this was on September 24, forty-seven days after the operation, and was probably due, as the patient suggested, to over-indulgence in food.

The button was passed without difficulty on the twenty-seventh day. There was some increase of strength and vigor at first, but the improvement was not progressive. About October 10 the abdominal pains from which the man had been quite free returned. On the 12th he was quite weak, and vomited a little blood. On the 14th there was a moderate hæmorrhage from the stomach, and a very large amount of blood was passed by the bowel; the patient being severely shocked in consequence. The hæmorrhages recurred on the 15th, from which the patient died.

An autopsy was performed and the stomach and attached bowel secured. Owing to the large tumor mass and the universal adhesions, the specimen could not be removed satisfactorily, but was considerably mutilated. The stomach was distended with clotted blood. The carcinoma had eroded the wall of the stomach and had caused the fatal hæmorrhage. Numerous metastatic deposits were seen on making sections of the liver.

The specimen is of especial interest on account of the size of the opening between the stomach and intestine, which is quite twice the diameter of the button employed. The union is in every way all that could be wished for.

The question is frequently raised as to whether it is worth while to perform an operation on patients suffering from a malady that must end fatally in a short time. In the present instance the result fully justified the course taken. The patient was asked some days after the operation if he felt satisfied up to that time. He replied that the relief from hunger and the absence of pain and vomiting experienced during any one day fully compensated him for all the risk and inconvenience he had incurred.

TRANSACTIONS

OF THE

CHICAGO SURGICAL SOCIETY.

Stated Meeting, March 7, 1904.

M. L. HARRIS, M.D., in the Chair.

OSTEOMALACIA.

DR. THOMAS A. DAVIS read a paper with the above title, for which see page 225.

DR. BAYARD HOLMES said he saw the patient first as he was conducting the essayist's clinic, but failed to recognize the condition of the arm, except that there was a fracture in a man, who was so evidently sick that he attributed the fracture either to some pathological lesion, or the failure of the bone to unite to his condition, and he did not at any time think of the possibility of sarcoma or of osteomalacia.

DR. M. L. HARRIS said there were some interesting points in the case, and the most interesting to him were that the patient seemed to have recovered from the general condition in which he was apparently before the operation. Another point was that the albumose which was present in the urine previous to the operation had disappeared. This brought up the question of whether this was a general condition primarily, or whether it was a local condition primarily affecting the general system. If it were a general disease, one could hardly understand how, after the removal of a portion of it, all of the general symptoms disappeared. If it were a local disease, and limited to the part or area which was removed, it was easy to see how the removal of that part might result in relief of the general condition. The presence of albumose had long been recognized in osteomalacia. If it was due to the condition in general, he did not understand how the removal

of certain parts, as was done in this case, would result in the disappearance of the albumose. The question of local origin or a diseased condition limited to the points mentioned and infecting the general system seemed to the speaker very likely.

Dr. Davis, in closing the discussion, said there were two points he had thought of since reading his paper. One was the patient insisted that within four days from the time the amputation was performed he was a different man, and that he was much stronger physically, and was able to get about the hospital. He no longer had the stiffness and weakness he formerly had. He thought this suggested the possibility of some locally generated toxic substance which was the cause of the man's myasthenia.

In relation to the myasthenia after the first exploratory operation for a few days, muscular function seemed little, if any, disturbed. Examination about a week later disclosed perfect sensation, but the patient could not contract the muscles. Dr. Davis said that myasthenia was generally spoken of by the authors who had reported cases, and, as the patient had perfect sensation, it would seem as if there might have been some trouble in the muscle itself which would account for the myasthenia, not of central, but of peripheral nerve origin.

Referring to the remarks of Dr. Harris, he stated that possibly the albumose might be the product of a large pathological area, and in diminishing that area by the removal of those parts which were most affected, leaving, as in this case, but few ribs which were still resilient and tortuous, there might be such a small quantity of albumose present as not to be detected in the urine. Albumose reaction might not be observed. This was the only other explanation, aside from the disease being a local one, with general manifestations, he had to offer.

NEPHRECTOMY FOR PYONEPHROSIS.

Dr. Frederick A. Besley presented a man, forty-five years of age, who for a period of twenty years had suffered from repeated attacks of pain in the left side. He describes them as "cramping" pain in the back and left side of the abdomen, radiating to the testicle. Heat applied over the site of pain would relieve it. The attacks of pain seemed to be less frequent after the application of a truss to an inguinal hernia which he had.

In the year 1895, he was operated upon by Dr. McArthur.

At this time he was suffering from headache, photophobia, ataxia, dizziness, falling, and hemianæsthesia of the right side. The operation revealed a cyst in left lobe of the cerebellum. This was drained and the recovery was perfect.

The patient was referred to the reporter by Dr. H. M. Richter. He had been ill about two weeks before admission to the hospital, complaining of severe lumbar pain on left side, with chills and fever. The urine gradually decreased in amount. It contained albumen, casts, blood, and pus. About forty-eight hours before coming to the hospital, there was almost a complete suppression of urine; patient became delirious, and finally comatose.

He was admitted to the hospital, April 1, 1902, in the following condition: Semi-unconscious, pupils equal and responding to light; the skin was hot and dry; tongue heavily coated. His temperature was 104° F.; pulse, 134; respiration, 56. During the first twenty-four hours he voided 450 cubic centimetres of urine. It contained albumen, casts, blood, and pus. During the next twenty-four hours the amount of urine increased materially, and on the third day he voided 2000 cubic centimetres with a specific gravity of 1015; cloudy; alkaline reaction; urea, 1.5 per cent.; trace of albumen; numerous casts; some pus and blood.

His general condition improved rapidly until the fifth day, when he had a chill and his temperature went to 102.8° F.

At this time a small tumor could be felt in the region of the left kidney. His condition grew steadily worse, with gradual enlargement of the left kidney. Temperature was irregular and pulse high. Blood showed a leucocytosis, 12,500. On the tenth day it was decided to explore the kidney and evacuate the suspected collection of pus, although consultants advised against this procedure because of the almost hopeless condition of the patient. The Harris segregator was used, and showed the right kidney to be active, with no urine coming from the left ureter.

A very small amount of ether was administered, and an oblique incision parallel to the twelfth rib was made and the kidney quickly exposed. The organ was distended and fluctuating. A large forceps was inserted and about 500 cubic centimetres of pus evacuated. The pelvis was explored with the finger and found to be dilated, but contained no stone. A large rubber tube was used for drainage. The patient improved rapidly, but did not fully recover, there being evidence of a chronic sepsis. The lumbar

sinus remained open, discharging urine and pus. The left ureter did not become patent. The urine from the right kidney was practically normal.

This condition remained unchanged until June 28, 1902, when the kidney was removed through a lumbar incision. The patient made a perfect recovery. The urine at the present time is normal.

CLINICAL NOTES ON APPENDICITIS.

Dr. Bayard Holmes presented the following cases:

(a) *A Buried, Erect, Vertical, Retrocæcal Appendix, with Appendicitis;* (b) *A Partial Appendicitis;* (c) *Ambulatory Treatment after Appendicectomy;* (d) *Two Unexplainable Deaths after Appendicectomy: One with Findings of Acute Yellow Atrophy of the Liver.*

SEVERE LACERATION OF THE ABDOMINAL MUSCLES.

Dr. Daniel N. Eisendrath exhibited a man who he said was the victim of the new style of cars which were being used in Chicago. The old-style car left enough space, so that one could stand between two cars passing in opposite directions, whereas these sixty-feet cars left such a small space that there was not enough of room or space to protect oneself. The patient was admitted to his service at the Cook County Hospital on the first day of June, 1903. He and his companion were trying to get on a Wentworth Avenue car at Polk Street, and in so doing his companion was hit by a car coming in an opposite direction and brought to the hospital dead. The patient suffered great shock. He was seen about two hours after his admission to the hospital by the speaker. The interne (Dr. Snyder) at that time found over the crest of the ilium a tumor about the size of two fists, which was tympanitic on percussion, and which he could replace. Dr. Eisendrath thought at first it was only a hæmatoma, but on being able to replace the tumor with gurgling, he agreed with Dr. Snyder that the diagnosis was a traumatic hernia through the triangle of Petit. Other injuries were fractures of the fifth and sixth ribs, with pneumothorax, and dislocation at the outer end of the clavicle. Patient did not give consent to operation that evening, but the next morning did so. The speaker made a large incision, which extended almost from the anterior superior spine of the ilium down to

the middle of Poupart's ligament. Much to his surprise, upon cutting through the skin he immediately entered the peritoneal cavity. He found the most extensive laceration of the abdominal muscles he had ever seen or had been reported, so far as he could learn. The skin itself was not contused or abraded. The injury extended so as to involve all the abdominal muscles, the external oblique, the internal oblique, the transversalis fascia and peritoneum, all being torn from the erector spinæ muscle down to the internal abdominal ring. In fact, everything was torn from the crest of the ilium to the outer part of Poupart's ligament. There were large pieces of omentum lying in the wound, with extensive contusion of the ascending colon and cæcum. He could not suture peritoneum to peritoneum, because he could not find where it was in the iliac fossa. At first, he thought of drilling holes through the ilium and bringing sutures through the perforations, but as this would take too long, he adopted the plan of using a mattress suture such as is used by Dr. E. Wyllys Andrews in the ordinary treatment of a case of inguinal hernia. He went through the gluteal fascia, and then with a mattress suture of kangaroo tendon sutured the muscles and brought them out again through the gluteal fascia, after which they were tied. He brought all of the muscles beyond the crest of the ilium. He used altogether fourteen sutures.

He exhibited the patient, believing that it would be more interesting to see the result than any description of the case which he might give. There was absolutely no recurrence of the hernia; no bulging at any point. The patient claimed never to have had an inguinal hernia before sustaining this crushing injury, but after the injury a left-sided inguinal hernia made its appearance, which was of considerable size.

CONGENITAL AND INFANTILE OMENTOCELE.

Drs. Jacob Frank and William T. Eckley read a paper with the above title, for which see page 204.

ANNALS OF SURGERY

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ORIGINAL MEMOIRS.

CONTRIBUTION TO THE SURGERY OF NEUROFIBROMA OF THE ACOUSTIC NERVE.[1]

BY JOSEPH FRAENKEL, M.D., AND J. RAMSAY HUNT, M.D.,

OF NEW YORK.

WITH REMARKS ON THE SURGICAL PROCEDURE.

BY GEORGE WOOLSEY, M.D., AND CHARLES A. ELSBERG, M.D.,

OF NEW YORK.

THE rapid advances made during recent years in our knowledge of the location of functions in the cerebral cortex and the function and course of various conduction paths within the brain have rendered possible the localization of a large number of brain tumors.

In some instances, especially when situated in the Rolandic area or at the base of the brain implicating cranial nerves, the location of the neoplasm may be indicated with great exactness; more often, however, only an approximate idea of its situation is possible.

An estimation of the size and character of the growth is nearly always a mere matter of speculation, based on tumor

[1] Read before the New York Neurological Society, February 2, 1904.

statistics, the rapidity of the clinical course, or associated constitutional conditions.

In tumors situated near the surface of the brain, a differentiation into cortical, subcortical, or supracortical is uncertain and often impossible. So that in the present state of our knowledge an operation for the relief of brain tumor when not palliative is essentially exploratory in nature.

The most encouraging results and brilliant successes attend the removal of cortical growths, especially those which do not infiltrate the brain substance and are easily enucleated.

So that, generally speaking, any group of tumors in which the localization, nature, approximate size, and enucleability could be asserted before operation, would be especially distinguished as favorable for surgical interference.

We believe that the class of tumors under consideration, the so-called acoustic neuroma, constitutes such a group, and therefore possesses surgical possibilities and importance.

The deep situation of the growth in the triangular space at the base of the brain, formed by the junction of the cerebellum, medulla, and pons, however, presents a serious obstacle, and renders any operative procedure difficult and dangerous.

The pathology, symptomatology, and diagnosis of these tumors have been discussed at length in a previous communication by the writers. (Tumors of the Ponto-medullo-cerebellar Space, *Medical Record,* December 26, 1903.)

In the present study, the surgical aspect will receive more especial consideration.

The acoustic neurofibroma is a firm nodular growth (a neurofibroma) springing from the acoustic nerve as it emerges from the junction of the pons and the medulla. Hence the initial and most important symptom is referable to a disturbed function of the auditory nerve. (Tinnitus aurium, Ménière's syndrome, and deafness.)

The proliferation of a neurofibroma is slow, and the conductibility of the nerve-fibres is maintained for a considerable time.

The anatomical features of the location of the tumor, a preformed excavation as it were, offer some possible explanation of the periods of latency observed.

At this stage a neoplasm of the auditory nerve might be suspected; a certain diagnosis would be impossible.

With the gradual proliferation and increase in size of the tumor, adjacent structures are pressed upon, and symptoms due to compression of the pons, medulla, cerebellum, and adjacent cranial nerves are added to the clinical picture. The general symptoms of brain tumor also become manifest.

At this stage the recognition of these tumors is possible.

The symptoms may be conveniently arranged in three groups:

1. General. Headache, vertigo, vomiting, optic neuritis, bradycardia.

2. Focal. Peduncular ataxia, cerebellar ataxia, lateropulsion, hemi-asynergy, homocontralateral and crossed paralyses of the extremities, paralysis of the basilar cranial nerves, especially the seventh, sixth, and fifth, dysarthria, dysphagia, nystagmus, paralysis of the conjoint movements of the eyes, inequality of the pupils, and attacks of Adams-Stokes syndrome.

3. Special. Serious impairment of the function of the auditory nerve of long standing and gradual onset.

Other pathological conditions in the posterior fossa of the skull might simulate this condition; but the initial auditory nerve symptoms, and the very gradual evolution of the clinical picture produced by a proliferation in the cerebellopontile angle, should render differentiation possible.

These tumors vary in size from a cherry to a bantam's egg. They are of fibrous structure, enveloped in a smooth capsule and present a nodular surface. They are loosely attached to the surface of the base of the brain by the leptomeninges, blood-vessels, atrophic nerve-trunks, and a few adhesions. So that enucleation is readily performed, leaving a smooth depression. Occasionally nodulations and thicken-

ings are said to extend along the auditory nerve to the internal auditory meatus. Rarely the acoustic tumor is bilateral, and other cranial nerves may be affected.

Regressive metamorphoses, hæmorrhagic areas, and sarcomatous transformation may occur, although the growth is essentially a benign one.

[FROM THE PATHOLOGICAL LABORATORY, CORNELL UNIVERSITY MEDICAL COLLEGE.]

CASE I, reported by Dr. Hunt.—The patient was admitted to Bellevue Hospital, April 23, 1903. Service of Dr. Alexander Lambert, by whose courtesy I was permitted to study and record the case.

Summary.—Onset and initial symptom six years before with tinnitus aurium and slowly progressive diminution of hearing in the left ear; two years later a tendency to stagger, occipital headaches, vertiginous seizures, and fainting spells. Up to the year previous to admission all the symptoms had gradually increased in severity. Marked disturbance of the gait and equilibrium. Deafness in the left ear. Severe occipital and frontal headaches, with vertigo. Failing vision. Symptoms on admission were cerebellar and peduncular ataxia, with a tendency to fall backward and to the left. Double optic neuritis. Lateral nystagmus. Dilated and unequal pupils. Dysarthria. Paræsthesia and objective sensory disturbances in the distribution of the left fifth nerve. Paresis of the left seventh with electrical changes. Nervous deafness in the left ear. Based on the duration and chronological relation of the symptoms, the clinical and pathological diagnosis of a neurofibroma of the left acoustic nerve was made.

Operation.—The occipital bone was trephined to the left of the median line below the lateral sinus. The opening was enlarged by the rongeur forceps in the direction of the foramen magnum. The dura mater and cerebellar hemisphere bulged into the opening and did not pulsate. The finger was passed along the inferior surface of the cerebellum to the tumor, which occupied the triangular space formed by the junction of the pons, medulla, and cerebellum. It was firm and nodular and easily detected by palpa-

tion. The growth was broken up and removed in fragments by digital manipulation. Death occurred twelve hours later from cardiac and respiratory failure.

Autopsy.—The left cerebellar hemisphere in the field of operation had suffered some laceration, but without serious hæmorrhage at the base. There was, however, a hæmorrhagic focus within the left middle peduncle of the pons, which had extended inward towards the median line and was the immediate cause of death. Histologically, the tumor was a neurofibroma.

History.—The patient was a Russian Jew, aged forty-two years, a pedler by occupation. His mother and one brother died of pulmonary tuberculosis. Six brothers and one sister are living and in good health. There is no family history of tumor or any grave mental or nervous affection. He is the father of three healthy children; no miscarriages. Habits are moderate; no venereal infection. Eight years ago he received a severe blow in the back of the head from a fist, followed by momentary unconsciousness; no apparent after effects.

When first admitted to Dr. Lambert's ward, the man had but recently been transferred from Mt. Sinai Hospital. He was very much excited and confused; could not be prevailed upon to remain in bed, but would fall out, staggering and dragging himself around the ward.

As the vision was very much impaired and he could scarcely stand, it was feared he might incur some injury, so that restraints were applied to the wrists and ankles. I saw him a few hours later. He was then crying out, jabbering in Yiddish and tugging on the restraints. On being questioned, he would cease his efforts for a moment, giving a fairly intelligible answer, but then, apparently unable to control himself, would begin to toss about again, yelling and moaning. The pupils were moderately dilated and unequal, the left wider than the right; light reactions sluggish. Speech was thick and indistinct. There was a distinct weakness of the left seventh nerve, especially marked in the upper branch. After the restraints had been removed the patient became quieter, answered a few questions, but was still very confused and irritable. He was unable to stand alone, but would plunge backward, quite unable to maintain his equilibrium. A more thorough examination was postponed until the following day.

An examination of the eye-grounds by Dr. Alexander Duane showed a double optic neuritis.

April 24, 1903. Status Præsens. Patient is quiet and rational. Complains of headaches, chiefly in the occipital region, but also in the forehead; marked vertigo. He can stand for a short period alone, but then loses his balance and falls backward and towards the left side. On attempting to walk, after taking a few steps, he plunges backward and towards the left. While the tendency to fall is always backward and usually to the left, it rarely happens that he falls towards the right side. This inclination of the body backward and towards the left was confirmed by many subsequent examinations.

The legs are held widely separated and handled awkwardly, suggesting the cerebellar gait. The left leg sometimes gives way under him; while the direction taken by the patient in walking is in a line towards the left, no spiral or turning movements were at any time observed.

The gross motor power of the extremities is well preserved, save a slight general weakness of the left arm, which is also moderately ataxic. There is no ataxia of the right arm or of the legs in the recumbent posture. The tendon jerks of the arms are normal. The knee-jerks are exaggerated, more especially the left. The Achilles jerks are active, and there is a slight, easily exhaustible pseudo-ankle clonus. There is no hypotonia. The skin reflexes are normal. No Babinsky phenomenon. There are no paræsthesias or objective sensory disturbances, save in the distribution of the left trigeminus nerve, which will be referred to later.

Percussion of the skull was negative both as to tenderness and sound. The pupils are unequal and dilated, the left wider than the right, reacting feebly to light and accommodation. A slow lateral nystagmus develops as the eyeballs approach the extreme positions. No difficulty in deglutition, phonation, or in mastication. There is a distinct dysarthria. The articulation is thick and indistinct, with a tendency to division of syllables.

Cranial Nerves. The sense of taste and smell is subjectively unimpaired. The sight is almost gone, can scarcely count fingers held in front of the eyes. Double optic neuritis. The ocular excursions are normal (three, four, and six nerves).

The motility of the muscles of mastication is normal, and there is no evident atrophy. There are, however, paræsthesias (numbness and prickling) in the distribution of the left trigeminus nerve. Over this same area sensation is impaired to touch and pain; distinct spots of analgesia are present. On electrical stimulation the difference in the sensibility of the two sides of the face is clearly marked. The corneal and conjunctival reflexes are absent on the left side, and the left half of the tongue is heavily coated in comparison with the right.

The seventh nerve is paretic on the left side and of the peripheral type. This weakness is especially noticeable in the upper branch.

Electrical. Galvanic and faradic currents applied to the trunk of the facial nerve show diminished reactions on the left side. The reaction is especially sluggish in the upper branch. Applied directly to the muscles prompt reactions are elicited, of normal character, without reversal of the poles. The muscles supplied by the upper branch, however, show a quantitative increase.

Hearing is almost lost in the left ear. A watch-tick or a low voice is not heard. The vibrations of the tuning-fork are still faintly perceptible to aërial conduction on the left side. Applied to the vertex, they are referred to the right ear, although the patient also thinks he hears them faintly on the left.

The soft palate and tongue show no abnormalities of motility and no atrophy. Pulse and respirations are normal. The examination of the internal organs was negative. Urine normal.

The condition as outlined by this examination remained practically the same up to the time of operation. Variable headaches continued from time to time, not very severe, and located chiefly in the back and front of the head; also vertigo; no vomiting. At times the gait and station showed a slight improvement, so that the length of the ward could be traversed alone; but the tendency to fall backward and towards the left side persisted.

Mentally he was quite clear, although the memory appeared slightly defective, as evidenced by conflicting statements. There was none of the dulness or apathy so common in cerebral tumors.

From the general and focal symptoms just detailed, there could be no question as to the existence of a tumor in the posterior fossa of the skull, in the neighborhood of the cerebellopontile angle, encroaching on the neighboring cranial nerves.

The early and distinct involvement of the acoustic nerve suggested the existence of a neurofibroma of the acoustic. In the diagnosis of this condition, reliance is to be placed chiefly in the initial involvement of the auditory nerve and the chronological relation of the other symptoms.

The following facts were elicited with great care from the patient and were confirmed or corrected by the members of his family.

1. Six years ago he first noticed a diminution of hearing in the left ear. This had been preceded and was accompanied by tinnitus aurium, described as a roaring, whistling, buzzing, and sound of bells.

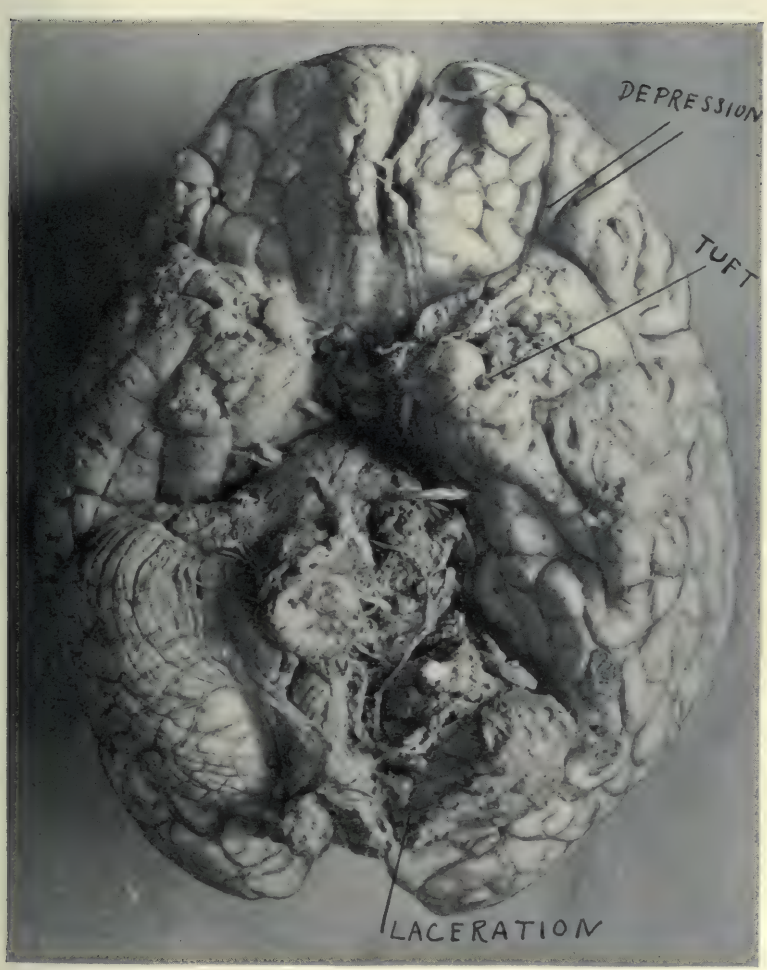
2. Two years later, in addition to the auditory symptoms, there developed a slight unsteadiness and awkwardness in the gait. The staggering at times was so pronounced as to be a source of embarrassment to the patient, giving the impression of being intoxicated. Vertiginous seizures were not uncommon, and headaches, chiefly in the occipital region, appeared about the same time. He had also occasional fainting spells with transient loss of consciousness.

3. During the last year all the above-mentioned symptoms had increased in severity. Headaches became severe and frequent with violent vertiginous seizures. The gait became staggering and uncertain and vision commenced to fail.

4. During the three months before coming under our observation locomotion had become more and more difficult, until walking or standing became an extremely precarious procedure, from the tendency to plunge backward. The dimness of vision passed into complete amaurosis.

(The paræsthesia and weakness of the left side of the face had caused the patient little or no inconvenience, and had practically escaped notice, so that the date of their appearance could not be ascertained with certainty.)

The clinical and pathological diagnosis of a neurofibroma of the left acoustic nerve was made, and the patient was transferred to the surgical ward for operation. The operation was performed, May 7, 1904, by Dr. George Woolsey. Immediately after the extirpation of the tumor, the breathing became irregular in depth and frequency, with alarmingly long intervals, and the pulse small, thready, and very rapid.



CASE I, FIG. 1.—Site of operation showing laceration of the cerebellum. Minute tufts and depressions in the cerebral cortex.

At 5 P.M., three hours after operation, the temperature was 102° F.; pulse, 112; respirations, 26.

At 9 P.M., temperature was 102⁴/₅° F.; pulse, 160; respirations, 40.

At 11 P.M., temperature was 102° F.; pulse, 140; respirations, 36.

At 1 A.M., temperature was 101° F.; pulse, 180; respirations, 44.

Death occurred at 1.30 A.M., twelve hours after operation, from cardiac and respiratory failure. The patient not having regained consciousness. Clonic spasms of the left side of the face were noticed. No convulsions.

Autopsy and Histological Examination.—The autopsy was performed thirty-six hours after death. Permission to examine the brain only, could be obtained.

On removing the calvarium, the outer surface of the dura mater was found studded with numerous minute tufts and excrescences, resembling somewhat the Pacchionian bodies, only more numerous and more widely distributed. As the dura was turned back, many of these were found attached to the cerebral cortex and were torn away, leaving at their point of attachment minute punched-out depressions on the surface of the convolution. From the base of many of these depressions soft, fungoid-like tufts project, apparently having no connection with the dura. These minute herniæ of brain substance, varying in size from a pin's head to a split pea, were distributed chiefly over the temporal and parieto-Rolandic regions, also sparsely over the frontal and occipital lobes.

These tufts microscopically are composed of glia cells and medullated nerve-fibres, without signs of inflammatory reaction, and represent real protrusions of brain substance.

The condition is to be regarded as of teratological origin.

The leptomeninges and circle of Willis are normal.

The Site of Operation (Fig. 1).—Corresponding to the original position of the tumor, there is a depression on the left side at the junction of the pons and the medulla. Excepting this pressure distortion, the brain stem presents no external evidences of injury. The inferior surface of the left lobe of the cerebellum has been lacerated. The laceration corresponding to the region traversed by the finger during the process of enucleation. Only two small fragments of tumor tissue remain, so that the extirpation has been practically complete. A few small, insignificant blood-clots were adherent to the torn surface of the

cerebellum, otherwise the base of the brain was free from hæmorrhage.

The roots of the seventh and eighth nerves were not demonstrable, and had evidently been torn away. The left fifth nerve is flattened out and compressed. The glosso-pharyngeal-vagus groups on the left side are somewhat matted together. The other cranial nerve-roots are normal, and in none are there evidences of a neurofibromatosis.

The vermis cerebelli was incised, and the right cerebellar hemisphere removed to expose the fourth ventricle. From the left side of the floor of the fourth ventricle there rises a rounded, dark-colored swelling covered by the smooth ventricular ependyma. This tumor-like projection from the floor of the ventricle corresponds to the field of operation on the basilar surface. On incision, it proved to be a hæmorrhagic infiltration in the middle peduncle of the pons, adjacent to the laceration in the cerebellar hemisphere and extending inward towards the râphe.

The aqueduct of Sylvius was not occluded by the swelling, and there is no free blood in the ventricular cavity. The general ventricular system of the brain is moderately dilated.

Microscopical Examination.—A series of sections was prepared from the various levels of the pons and medulla oblongata, including the lacerated portion of the left cerebellar hemisphere. The configuration of both pons and medulla has been altered by the compression of the tumor, the left half showing a considerable lateral flattening. There was no atrophy of the large tracts, sensory or motor, nor of the ascending roots of the glosso-pharyngeal and trigeminus nerves.

At the level of exit of the left fifth nerve there is a fresh hæmorrhagic focus in the middle peduncle of the pons, extending inward towards the median line. This hæmorrhage is immediately adjacent to the lacerated inferior surface of the left cerebellar hemisphere, which is also the seat of hæmorrhagic foci. (Fig. 2.)

A smaller effusion of blood is also present at the level of the acoustic nerve, standing in close proximity to the glosso-pharyngeal-vagus nuclei. (Fig. 3.)

Tumor.—The fragments of tumor removed at the operation showed the original growth *in situ* to have been about the size of a bantam's egg. The growth was of a soft, fibrous consistency and

CASE I.—Transverse Section of Pons.

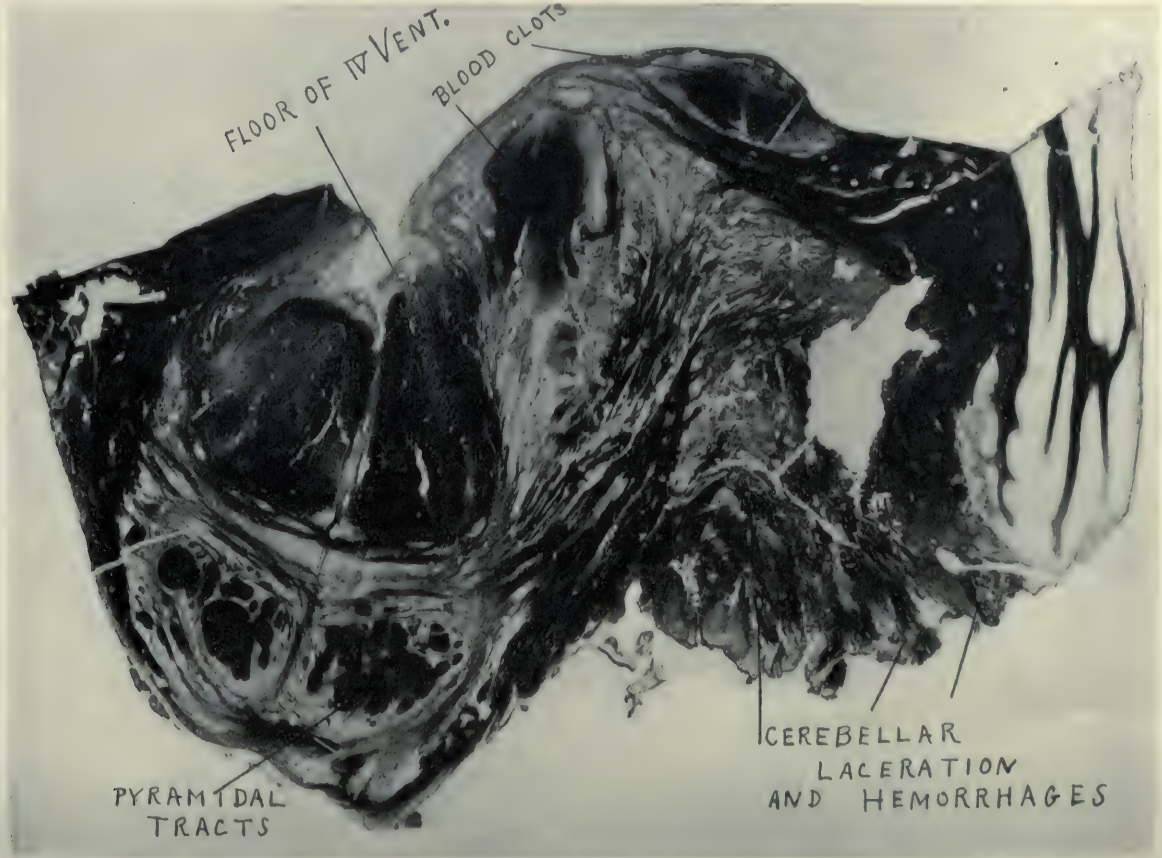


Fig. 2.—Weigert method. Section from the level of exit of the fifth nerve.
Laceration and haemorrhages of the cerebellar hemisphere. Haemorrhage in the left middle peduncle of the pons extending towards the median line.

CASE I.—Transverse Section of Medulla.

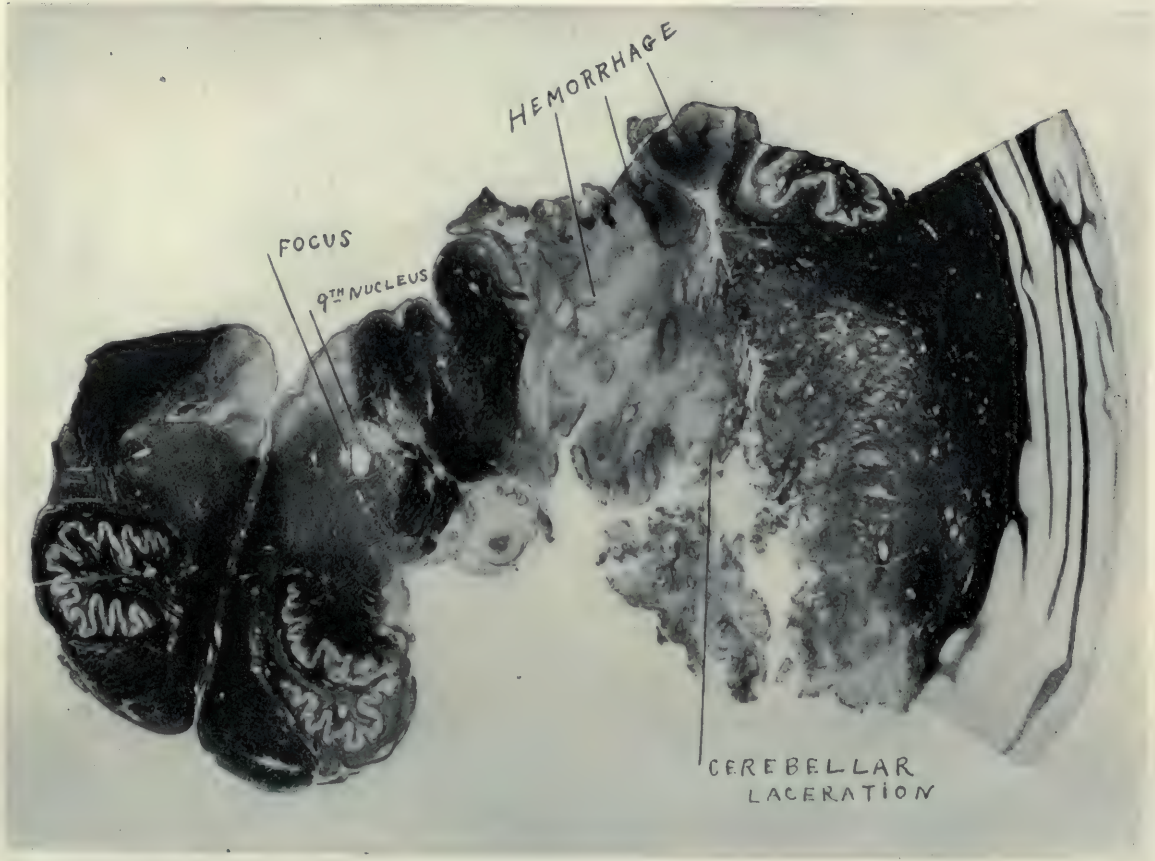


Fig. 3.—Weigert method. Line of the glosso-pharyngeal-vagus nuclei, showing hæmorrhage and laceration of the cerebellar hemisphere and a focus of hæmorrhage below the ninth and tenth nuclei.

somewhat nodular conformation, and was easily broken up between the fingers. The surface of section is of a gray, translucent, or pearly white tint with a few hæmorrhagic foci and areas of retrograde metamorphosis.

Histologically, the neoplasm is a neurofibroma. Medullated nerve-fibres were demonstrable within the substance of the growth by the Weigert method. There are no evidences of sarcomatous transformation.

DESCRIPTION OF THE OPERATIVE PROCEDURE IN CASE I BY DR. GEORGE WOOLSEY.

At the time of operating on this case, the writer was not aware that any operation on similar cases had been reported which might serve as a guide in this case.

In this, the first operation undertaken on a tumor of this kind, correctly diagnosed and localized, the problem presented was to remove a readily enucleable tumor in the pontomedullary angle, probably not directly connected with the brain. It seemed possible to accomplish this through a posterolateral opening, as large as possible, below the lateral sinus, through which the tumor could be reached beneath the cerebellar hemisphere.

Accordingly, a large flap of skin and underlying muscles, with its base inferiorly and laterally, was turned down, exposing the lower part of the left half of the squamous portion of the occipital bone and the posterior part of the left mastoid. The occipital bone was bared very nearly to the foramen magnum. After removing a button of bone with a trephine, the opening was enlarged as rapidly as possible with rongeur. The opening was thus made to extend from a little below the lateral sinus to a point close to the foramen magnum, and from a little to the left of the occipital crest laterally until the bone became so thick that its removal was slow and difficult. This brought it close to the sigmoid sinus.

The dura was tense and showed no pulsation. On opening the dura and turning it up as a flap, the left cerebellar hemisphere bulged considerably. The forefinger inserted beneath

this hemisphere in a forward and inward direction easily made out the tumor in the position diagnosed and at a distance from the opening in the bone, easily admitting the manipulation necessary for enucleation and removal. The tumor felt nodular and hard, and could be easily distinguished from the surrounding brain tissue. Its size was greater than was expected, and it was not thought feasible at the time to remove it entire. Hence it was removed piecemeal by the finger, which was done without much difficulty. This necessitated the frequent introduction and removal of the finger, and in the removal there was the extra bulk of the fragment of the tumor held by bending the end of the finger. This necessarily resulted in some laceration of the under surface of the left cerebellar hemisphere.

In order to avoid the accumulation of a blood-clot and its infiltration into or around the brain, a large cigarette drain was introduced to the situation of the tumor, along the tract followed by the finger. There was but little bleeding during the operation. The skin flap was sutured, leaving an opening for the passage of the drain. The operation was completed within an hour and a half.

It was not thought necessary to adopt Horsley's suggestion to operate in two stages, for during the stage of approach but little blood was lost, and at its completion the patient's condition was as good as at the commencement of the operation.

During the removal of the tumor the respiration became irregular in rhythm and depth. When the patient was returned to bed after operation, this had much improved, and the pulse had responded to stimulation and was quite satisfactory. This condition continued for three or more hours, and then the patient went into collapse, which did not yield to any method of stimulation.

The autopsy showed that death was due to hæmorrhage within the left middle peduncle of the pons. The writer was convinced that this was due to the traumatism indispensable

to the frequent introduction and withdrawal of the finger, especially as in withdrawing the finger it had to be bent at the end to remove the fragments of the tumor. The enucleation and breaking up of the tumor were easily done; the traumatism was inflicted in withdrawing the finger with the tumor fragment. This traumatism could be minimized by passing a curved vulsellum along the finger and seizing the tumor, enucleating it with the finger, and then withdrawing it *en masse* after removal of the finger. That this course was not followed was owing to the size of the tumor, which was larger than expected; but in spite of this, the writer is now convinced that it could have been safely done and the fatal injury to the pons probably avoided. Some laceration of the inferior surface of the left cerebellar hemisphere was anticipated, but this laceration is unimportant, and some of this part of the cerebellum could have been excised with impunity to facilitate the extraction of the tumor. The writer is satisfied that removal of such tumors by the route employed is feasible and can be successfully accomplished, especially if the tumor is somewhat smaller.

The route followed was not directly from behind forward, but from a posterolateral opening forward and inward. From the position of this opening, the route to the pontomedullary angle is about as short as any from the cranial surface, for the opening extended very close to the foramen magnum; but of course the enucleation and removal have to be done by the sense of touch alone.

The disadvantage of the approach from a more lateral position lies in the thickness of the bone here and the longer time and greater loss of blood necessitated in making the requisite opening. This objection can be obviated in some measure by doing the operation in two stages, as undertaken in Dr. Elsberg's operation in a subsequent case.

The exposure of the tumor and the field of operation claimed for this more lateral approach are also a distinct advantage. It is an open question, however, whether this advantage exists in practice, for the increased intracranial pressure causes such a bulging in every possible direction that the con-

ditions are far different from what they are postmortem or on the cadaver.

In view of the above considerations and the definite localization and easy enucleation of such tumors, the writer is convinced that their surgical removal is feasible, and that its successful performance may be expected in a fair proportion of cases, especially if they are diagnosed and operated upon as early as possible, before they have attained a large size.

CASE II, reported by Dr. Fraenkel. *Summary.*—Male, forty-eight years old. Disease began five years ago, with progressive diminution of hearing on right side. One year later, difficulty of locomotion. Right lower extremity affected first. One year later, increase of locomotor difficulty; gait of drunken man. Transient diplopia and propulsion. Two years ago noticed the occurrence of an ankle clonus. Since two years, impairment of vision and difficulty of speech. Ataxia. Since one years, sphincteric difficulties.

On examination, static and locomotor ataxia; falls and inclines to left side; tenderness in right mastoid region; some mental apathy; stammering speech; bilateral choked disk; nystagmus; paralysis of right side of face (developed four months after admission); motor paresis and spasticity of left-sided extremities; some spasticity of right side and marked right-sided ataxia.

Preparatory operation, January 21, 1904, by Dr. C. A. Elsberg. Patient died forty-eight hours after operation.

A. G., forty-eight years old; single; theatre manager; born in United States; was admitted to the Montefiore Home, July 21, 1903.

Family History. Father died at sixty-two from Bright's disease. Mother living, seventy-eight years old. One brother died at age of seven, and imbecile; a paternal cousin died insane.

Personal History. Born naturally; was the third child; began to walk at proper time; had measles and scarlet fever. Nutrition was good in childhood; no rhachitis. Went to work as office boy at fifteen for four years. Later was a retail butcher and was in remarkably good physical condition. After six years

went on the road as theatrical manager and travelled all over the country. Always lived comfortably; had sufficient hours of rest; drank liberally of beer, whiskey, and champagne. Inveterate smoker. Gonorrhœa six years ago. Epididymitis. Syphilis denied. Bowels regular up to seven years ago, when tendency to costiveness developed.

Present Disease.—About five years ago he noticed that hearing became defective on right side; had to use left ear when telephoning. One year later gait became staggering; he had to walk on a broader basis, felt somewhat uncertain, swayed slightly. Within six months this difficulty increased markedly; the gait assumed the distinct characters of a "marche d'ivresse," so that he frequently was believed to be intoxicated. About the same time diplopia occasionally put in an appearance. One-half year later the co-ordination of the lower extremities became still worse, and was particularly annoying when he had to walk on inclined surfaces. Under such conditions he had a marked propulsion, could not stop himself, frequently ran into cars. Since about two and one-half years, patient noticed that his feet began to "beat a tattoo" when in certain positions, sometimes both feet, more often the right. Since about fourteen months is confined to bed or chair. Since about two years progressive impairment of vision; speech and handwriting are also impaired since. Pronunciation has become difficullt and patient is unable to write on a given line. During this time he also noticed progressive loss of co-ordinatory power of his hands (unable to button shoes, feed himself neatly, etc.). "Cannot judge distances when reaching for articles, has lost confidence in his movements."

The patient is mentally fatigued by reading or any other effort, gave up all work since two and a half years. During the last year had frequently vesical incontinence, and could not restrain the flow when the desire came. Similar disturbances of the rectal musculature have occasionally occurred. Never had pain, paræsthesias, girdle sensation, or vomiting. Headache occasional on top or back.

Present Complaints (July 25, 1903). Patient weighs 140 pounds; of good nutrition; rather short stature; stands for a short while with feet widely apart; marked titubation; inclines and falls towards the left side; complexion is sallow and subicteric; no scars on skin, no glandular enlargement; a few pig-

mented and vascular moles; regional varicosities of veins; no other dermal abnormalities.

Circumference of head, fifty-two centimetres; brachycephalic; auscultatory percussion of skull is negative; marked tenderness in right mastoid region; slight mental hebetude, speech hesitating, syllabic.

Face. Lines well marked, innervation equal.

Eyes. Position normal; on lateral movements, horizontal nystagmus; on vertical movements and during fixation of eyeballs, rotatory nystagmus; slight clonic twitchings of right lower lid; palpebral reflex diminished; pupils equal, regular; all reactions present. No limitation of visual fields.

Ophthalmoscopic Examination by Dr. E. S. Peck.

August 5, 1903. O. D. Optic nerve can be traced under a papillitis surrounded by a complete perioptic effusion. Retinal veins are tortuous in all directions. The upper outer retinal vein is lost just outside disk, as if buried under effusion.

O. S. Condition of optic nerve same, with smaller amount of perioptic effusion.

August 8. O. D. V, $^{12}/_{100}$. O. S. V, $^{12}/_{40}$.

O. D. Peripheral V good in all directions, except above; vision above is lost down to 40.

O. S. Field of vision good in all directions, in fact, almost perfect.

O. D. Above and to temporal side of optic nerve can be counted six small spots of hæmorrhage seen through the effusion, already noted.

O. S. Three or four hæmorrhagic spots can be counted in close proximity to optic nerve.

September 9. O. D. Contour of optic nerve clearer, hæmorrhages apparently diminished.

O. S. ditto.

September 10. Examination by Dr. Karl Koller. Neuritis; optic nerve not well defined and congested (difficult in undilated pupils). Disks not well defined and retina not participating.

Ears. Normal size and shape; hearing on right side very much diminished.

Examination by Dr. Felix Cohn. Without tuning-forks, evidences of probable acoustic nerve involvement on right side. Hearing appears to be not absolutely lost.

Tongue is large, broad, not coated; protruded, straight. Sublingual veins are large and varicose. Motility of pharynx normal; uvula is long, has a beaded appearance, deviates slightly to the right side; pharyngeal reflexes very diminished. Clonic twitchings of right platysma myoides. Varicosities along the right jugular vein.

Motor functions of chest and abdomen normal; cremasteric reflexes absent; the other skin reflexes present and normal.

Upper Extremities. Volume equal and good; no deformities or atrophies. No tremors when at rest. Marked coarse, intentional tremor of upper extremities. Tendon reflexes exaggerated.

Lower Extremities. Good volume; some loss of power, more on left than on right side. Hypertonia not marked. Knee and Achilles jerks exaggerated; more marked on left. Plantar reflex; Babinsky type on left side, normal on right side. Coarse tremor of right vastus internus and gluteus maximus muscles. Sensory functions normal; some loss of deep sensibility of right upper extremity.

Thoracic and abdominal viscera normal. Pulse 72, of normal qualities; urine normal.

Decursus Morbi.—August 7, 1903. Slight frontal headache on right side; twitchings of right-sided muscles of neck.

August 18. Rectal incontinence.

August 23. Awoke with severe headache; few hours later lost consciousness; fell out of chair.

August 25. Patient is somewhat confused and wandering.

September 3. Last three days and two nights attacks of singultus.

September 27. Complains about frequent headache and increased salivation.

December 3. Attack of vertigo; loss of consciousness.

December 12. Slight transient right-sided lagophthalmus.

January 4, 1904. Mental condition slow; patient is easily confused; conjunctival and corneal reflexes of right side absent; incomplete paralysis of right seventh; marked clonic twitchings in upper and middle branches of this nerve. Deficient innervation of right half of soft palate; marked ataxia of left upper extremity; marked spastic paresis of right-sided extremities.

Examination of Sense of Taste gave the following result:

Right.	Syr. Simpl.	Chin. Sulph.	Acid Tartar.	Ol. Citr.
Anterior one-third of tongue,	not perceived,	salty,	acid,	lemon.
Middle one-third of tongue,				
Posterior one-third of tongue,	sweet (delayed),	salty,	acid,	lemon.
Left.				
Anterior one-third of tongue,	not perceived,	not perceived,	not perceived,	not perceived.
Middle one-third of tongue,				
Posterior one-third of tongue,	sweet,	salty,	acid,	lemon.

Sensation of touch impaired in left anterior one-third of tongue.

Pain sensation delayed in same area.

The electrical examination showed quantitative diminution of the excitability of the right facial nerve.

January 7, 1904. Very marked tenderness of right mastoid region; marked total paralysis of right side of face; characteristics of a peripheral lesion. Occasional clonic twitchings of musculature of right side of face; marked loss of kinesthetic sensibility of left upper extremity. Abdominal and cremasteric reflexes absent on both sides.

The diagnosis of neurofibroma of the acoustic was the only one possible to reach. In view of the fact that the optic neuritis has not reached a stage incompatible with the expectation of improvement, operation was advised. Patient and his family were informed of the dangerous nature of the procedure.

Preliminary craniotomy was performed by Dr. C. A. Elsberg, January 21, 1904.

Only the first step of the operation was performed; patient died forty-eight hours after the operation, apparently in uræmic coma. The post-mortem inspection demonstrated the tumor in expected locality and of expected nature (neurofibroma). (Figs. 4 and 5.)

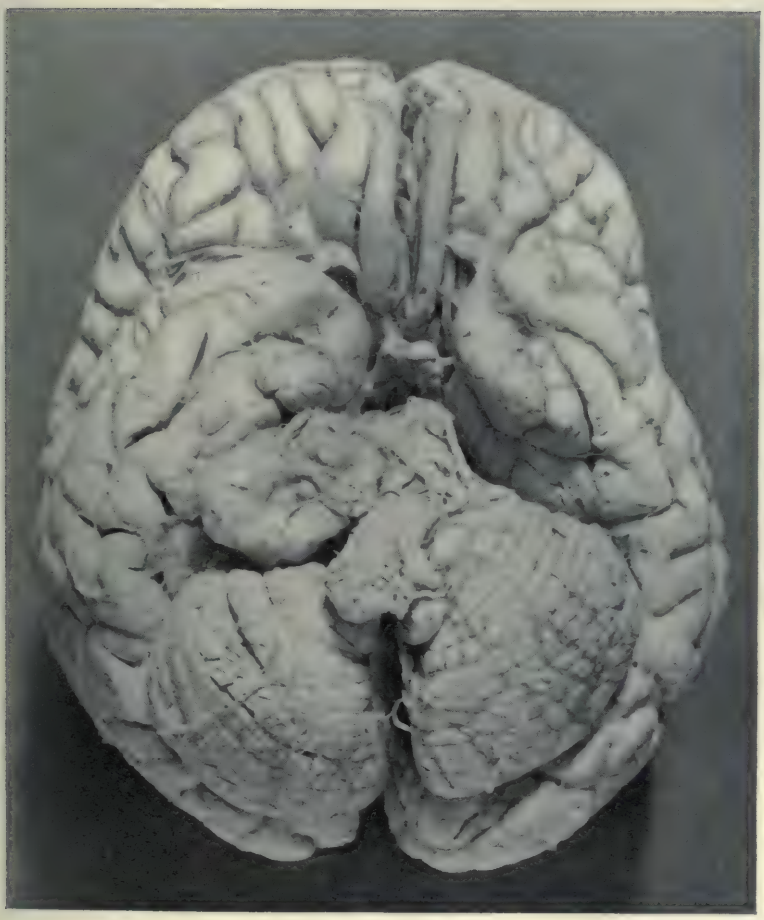


FIG. 4.—Showing tumor in situ.

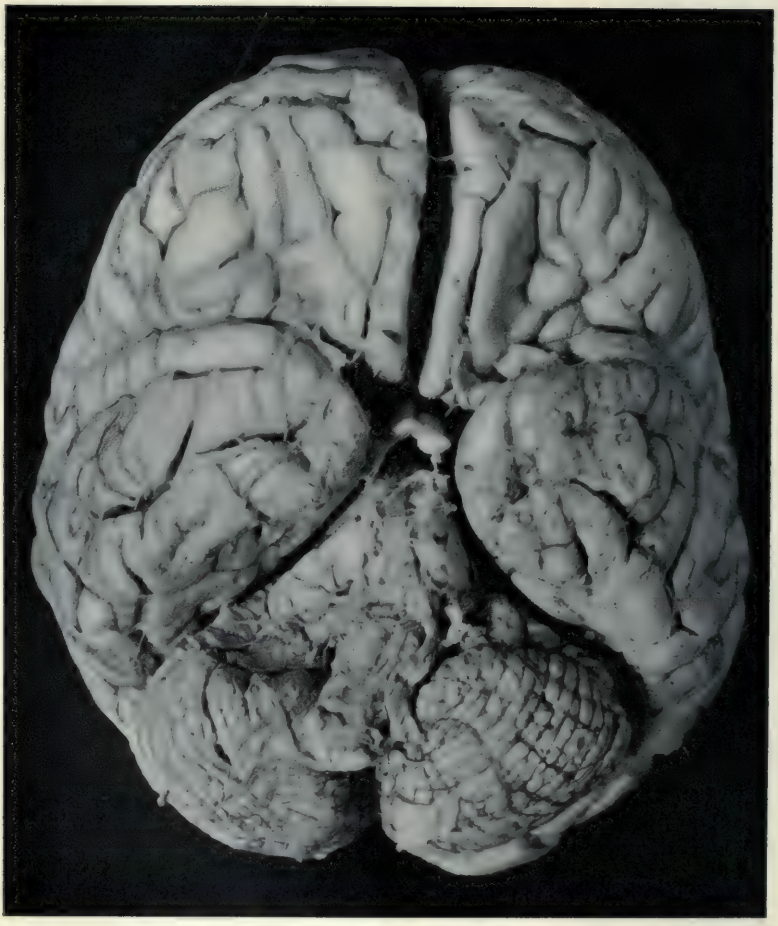


FIG. 5.—Showing depression after removal of tumor.

REMARKS ON THE OPERATION IN CASE BY DR. C. A. ELSBERG.

Incision beginning at the apex of the mastoid process on the right side, running upward to the level of the superior curved line of the occipital bone, then curving outward and then downward about four centimetres from the median line of the neck to end at the level of the beginning of the incision. This skin flap, including the periosteum, was turned down after the bleeding from the soft parts, which was quite active, had been stopped. In the middle of the area of bone thus exposed, a small button of bone about three centimetres in diameter was removed with the cranial drill, and with chisel and cranial rongeur the opening was enlarged in all directions. The lateral sinus was exposed over a distance of five centimetres in its horizontal course, as well as the entire descending loop down to the point where the sinus enters the jugular foramen. The removal of the bone occupied considerable time, as the skull was very thick. The opening in the bone measured about eight centimetres in its vertical and five centimetres in its horizontal diameter, and extended from about two centimetres above the level of the superior curved line of the occipital bone down to within one and three-fourths centimetres of the margin of the foramen magnum, and laterally from within one centimetre of the external auditory meatus outward for five centimetres to three centimetres of the median line.

In the upper part of the wound the posterior surface of the right occipital lobe covered by dura mater was visible, and in the lower part, the outer portion of the posterior surface of the right lobe of the cerebellum covered by its dura. The cerebellum bulged more than normal, and its pulsation was only very feeble.

After some oozing from the bone had been stopped with bone wax, the skin flap was turned back into place, and the entire wound closed with interrupted silk sutures, a small rubber drain having been inserted in the lowermost wound angle. A voluminous dry dressing was then applied.

Operation. Quantity of blood lost during operation (estimated), ten ounces. Condition of patient at conclusion of operation, fair; considerable shock; pulse, 120 and compressible; respirations, regular and deep.

Remarks. The patient did not stand the operative interference well, as his pulse became weak as soon as the incision in the soft parts of the scalp had been made.

The scalp was very vascular, but the bleeding was readily controlled. The hæmorrhage from the bone came from a vein in the mastoid process, but it was readily controlled and stopped with a small quantity of Horsley's bone wax.

At no time during the operation was any interference with the respiration observed.

Clinical Course after the Operation. The patient seemed to be in a condition of considerable shock when first returned to his bed. His respirations were slow and deep; his pupils contracted and equal; temperature, 100.6° F.

Within one hour of the operation, twitchings were noticed in the paralyzed facial nerve, its lowermost branches, and within two hours there was some voluntary movement in some of the branches of the nerve.

The patient was partly conscious in three hours and fully conscious in about eight hours.

During the first twenty-four hours the patient was energetically stimulated, and his general condition improved very much. He was fully conscious; did not complain of much pain; his respiration was very regular; his pulse was 120, and of fairly good quality. He had passed very little urine, however, and was therefore given subcutaneous infusions of normal saline solution at frequent intervals.

In spite of energetic treatment, his kidneys would not respond, and less than one-half ounce of urine was secreted during the following twelve hours. He gradually went into the uræmic condition, became comatose, and died on the morning of January 23, about forty-two hours after the operation.

Post-mortem Examination of the Wound. The skin flap

was turned down after the skin sutures had been divided, the wound looked clean, and there was but little secretion. The dura was incised along a line about three millimetres away from the sinus for a distance of about five centimetres, and the lateral part of the cerebellum thus exposed. Palpation with the finger at once revealed the tumor only three centimetres from the surface and lying in the posterior fossa near the apex of the petrous portion of the temporal bone. Its removal could probably have been accomplished with ease and with considerable rapidity.

The opening in the skull in our patient was made in a rather unusual situation, and it may therefore not be out of place to state briefly the reasons for the method here employed.

In most of the operations for a tumor in the posterior fossa, the cerebellum has been exposed by the so-called occipital craniotomy, in which an opening is made in the occipital bone somewhere between the median line and the posterior margin of the mastoid, and below the level of the lateral sinus. For tumors situated in front of the cerebellum, as was the tumor in our case, and for tumors in the anterior and lateral parts of the cerebellum, there are several objections to this method of exposure:

1. It is not the shortest route from the surface of the skull.

2. The manipulations in the removal of the tumor have to be done by the sense of touch alone.

3. Even with the most gentle manipulations, the cerebellum is apt to be considerably contused and its tissues injured.

4. In the digital examination of the anterior parts of the cerebellum from the under surface of the organ, the finger must come in frequent contact with the medulla and perhaps the pons; the great danger from only slight injuries to these structures is well known.

My object in investigating this subject was, if possible, to find a method by which the disadvantages above mentioned would be avoided.

As to 1. Actual measurements on a number of skulls showed that the shortest distance from the surface of the skull to the anterior edge of the lateral lobe of the cerebellum on the same side is measured on a line which runs along the posterior surface of the petrous portion of the temporal bone, and reaches the surface of the mastoid, one to two centimetres behind the external auditory meatus. The distance from the outer surface of the occipital bone below the level of the lateral sinus to the anterior edge of the cerebellum diminishes steadily as one makes measurements more and more distant from the median line. These facts show that the shortest route to the pontomedullary cerebellar space to the internal auditory opening in the mastoid process.

As to 2. If in the cadaver, an opening in the skull is made in the mastoid region and the dura incised, the lateral edge of the lateral lobe of the cerebellum falls away from the posterior surface of the petrous portion of the temporal bone, so that fully one-half of this part of the bone can be seen. With only very slight retraction, the lateral lobe can be drawn sufficiently towards the median line, so that the auditory and facial nerves can be plainly seen in their course from the pontomedullary cerebellar space to the internal auditory meatus and even the ninth, tenth, and eleventh cranial nerves can be seen in part of their course in the posterior fossa. The auditory nerve can be cut close to its origin with a fine scissors without touching the pons or medulla. I have performed the operation on the cadaver three times, and have become convinced of its feasibility. In the living body, where the cerebellum is filled with blood, the same conditions will be found, although to a somewhat less degree. This has been demonstrated by Krause, of Berlin, in a somewhat similar operation devised by him for a case in which he cut the auditory nerve in the posterior fossa for the relief of a persistent tinnitus aurium.

As to 3. As is well known, considerable of the lateral parts of the cerebellum can be cut away without causing a

permanent disturbance in the functions of this part of the brain. Therefore, this is the part of the cerebellum that can be handled with the greatest safety. As has been already mentioned, this is the part of the cerebellum that can be most easily retracted. From all of these facts, it must follow that the approach to the anterior edge of the cerebellum along its outer edge is not only the easiest, but also the route in which the organ is least apt to be injured during the necessary manipulations. Attention may again be called to the fact that with only very slight retraction of the lateral edge of the lateral lobe of the cerebellum, the greater portion of the posterior surface of the petrous portion of the temporal bone (which forms in that situation the anterior boundary of the posterior fossa) becomes visible.

As to 4. An examination into the anatomical relations of the structures in the posterior fossa will soon make it clear that when the pontomedullary cerebellar space is approached from the mastoid region along the outer edge of the lateral lobe of the cerebellum, neither finger nor instrument need come in intimate contact with the pons or medulla, until the space itself has been reached. It is probable that the correct way to remove tumors from this region is to expose the structures on the mesial side of the tumor, if possible, and to divide these first, and then to work outward all of the time away from the pons and medulla. In this way the danger of injury to these important structures is reduced to a minimum.

The writer believes that operations for tumors of the brain should always be done in two stages, and in the case here reported the first stage consisted only of the making of the necessary opening in the skull. Unfortunately, the patient succumbed to an acute suppression of urine on the third day after the operation, at a time when he appeared to have recovered from the shock of the operative interference.

GENERAL CONCLUSIONS.

1. We believe that the acoustic tumor syndrome is well defined, and that the diagnosis can be made with practical cer-

tainty. This presupposes not only the diagnosis of the location of the tumor, but its nature and comparative size. It must, however, be observed that other slowly growing pathological conditions in the posterior fossa might simulate closely this condition.

2. The slow and essentially benign nature of the growth, its non-infiltrating character and enucleability would all favor surgical interference.

3. The deep situation at the base in immediate proximity to vital centres offers *very serious obstacles.*

4. From personal observation, we believe that the surgical technique should be perfected along the following lines:

a. The avoidance of undue concussion in the removal of the bone and enlargement of trephine opening.

b. A method of extirpation by which the tumor could be extirpated without undue manipulation of the surrounding parts.

c. The division into stages, as recommended by Horsley, and celerity of execution.

5. The study of the literature of this subject is unsatisfactory because most of the cases are recorded under the heading of cerebellar tumors. We succeeded in collecting from the literature six other cases which presented the clinical and pathological characteristics of the acoustic neuroma. An abstract of these cases is appended below.

CASE I.—McBURNEY & STARR. *American Journal of the Medical Sciences,* 1893, page 377. *Fibrosarcoma of cerebellum and pons varoli. Operation; death.* Male, aged thirty years, presented general symptoms of tumor during a period of three years. For the past year diplopia; speech slow and thick. Numbness of left side of face; tinnitus aurium.

Status.—Left external strabismus; nystagmus; choked disk; slowness of speech; hebetude and great mental apathy; progression of symptoms; optic atrophy; complete deafness in left ear with staggering gait; marked tendency to fall forward and towards right side; weakness of right hand; knee-jerk exaggerated on right side, ankle clonus on right.

Operation.—Soft parts turned back over occipital region. Opening in left occipital bone with chisel and mallet, one and a half inches in diameter; marked bulging of dura incised; protrusion of cerebellar tissue; exploration made in all directions with index-finger without locating

tumor. Considerable laceration of cerebral tissue as result of manipulation. It was impossible to replace the prolapse. Excess shaved off. Wound healed by primary intention. Aseptic throughout. Patient died December 15; temperature, 105° F.

Autopsy showed gliosarcoma; left hemisphere of cerebellum, one-half pons and one crus slightly indented by tumor; one auditory and facial and fifth implicated in tumor.

Case II.—G. A. Gibson. *Edinburgh Medical Journal,* 1896. A woman, aged twenty-five years. Onset ten months before admission, with headaches, giddiness, and unsteadiness in walking.

Status.—Short dagger-like pains over left eye. Vertical and horizontal nystagmus; pupils unequal, the left wider than the right. Reactions prompt. Optic neuritis.

Deafness in the right ear. Regurgitation of liquids through the nose. Voice bleating in character. On walking falls to right side. Station with closed eyes is swaying, falls to the right.

Operation by Annandale. The tumor was size of pigeon's egg and was removed piecemeal. Histologically, a fibrosarcoma. Following operation the headaches and vertigo disappeared, swallowing was perfect, and the gait was much improved; a little nystagmus persisted.

This case was reported by Dr. Purves Stewart in the *Edinburgh Hospital Reports,* 1895, Vol. iii, page 447.

Case III.—Murri (Bologna). *Lancet,* 1897, page 292. Boy, aged seventeen. Onset with tinnitus aurium and vertiginous seizures resembling Ménière's disease. Later, diminution of hearing on the left side progressing to complete deafness. Some tinnitus and diminution of hearing on the right side as well. Left seventh paralysis with increased galvanic irritability. Tenderness over the left side of the face on pressure (fifth). The corneal and conjunctival reflexes absent on the left. Speech thick. Rotary nystagmus; later becoming lateral. Optic neuritis, more marked on the left.

In addition has headaches, vertigo, and vomiting. The attacks, resembling Ménière's, persisted twenty months after the onset.

Marked disturbance of the equilibrium; falls backward, forward, or laterally, but not constantly in any one direction. Ataxia of left arm and leg. Tendon reflexes exaggerated, especially on the left. Has spells of unconsciousness, with transient rigidity, lasting one-half hour; also paroxysms of extreme vertigo and mental confusion, the face flushing and the pulse falling to 60.

Operation by Dr. Guido Bendanni. A portion of the tumor was removed from the neighborhood of the left half of the cerebellum. Total extirpation was impossible.

Histologically, the growth was a fibrosarcoma. One month later the boy was still alive and rather better than worse.

Case IV.—Jaffé. *Deut. Med. Woch.,* 1897, No. 23, page 24. A woman, aged fifty-two years. General symptoms of brain tumor had existed for two years. Peculiar disturbance of gait; would turn towards the left side in a spiral manner. Evidences of pressure on the fifth, sixth,

seventh, and ninth cranial nerves on the right side. Acoustic not mentioned.

After trephining there was a discharge of bloody cerebrospinal fluid, the patient collapsing. The operation was not completed, and death occurred twelve hours later.

Autopsy.—On the under surface of the right cerebellar hemisphere, corresponding to the flocculus, is a polypoid-like tumor, compressing the middle peduncle of the pons. The sixth and eighth nerves are compressed and stretched by the tumor. The tumor was readily enucleable, and was so loosely attached that slight manipulation dislodged it. Microscopically, the growth was a fibrosarcoma.

CASE V.—SAENGER. *Neurol. Centralblatt,* 1899, page 117. A woman, aged forty-seven years. Duration of illness three years. Headaches, vomiting, blindness, double-choked disk. Impairment of memory. Hearing defective on the left side.

A palliative operation was performed. The trephine area was kept open for a month to allow the escape of cerebrospinal fluid. Following operation, vision improved with disappearance of the choked disks. A hemiparesis developed on the left side.

At autopsy a tumor about the size of a small potato was found in the left cerebellopontile angle, probably of acoustic origin.

CASE VI.—FRANK R. FRY (St. Louis). *Journal of Nervous and Mental Diseases,* March, 1904, page 157. Male, aged thirty-nine years. July, 1899, in Manila; tendency to go to the left; later, frequent vomiting in the morning; no nausea; twitching in fingers of right hand; some stiffness; rigidity of right face and right extremities; ataxia; tendency to move to left side; almost absolute deafness right side; throbbing in back of head; sensation normal.

Gait. Drunken stagger; inclines to left. Handwriting cramped. Ataxia of all extremities. Reflexes exaggerated, more on right side. Pupils normal. Eyes, right, 20/20; left, 20/20. Perimeter charts normal; disks showed swelling; slight hæmorrhage left at upper edge of disk. Eye-muscles worked in jerky way; tendency to nystagmus.

Locomotion became more difficult; ataxia more on right extremities, also face; writing impossible. Tendon jerks more plus on right side. The only disturbance of general sensibility was in the distribution of the right fifth nerve. Complained of unpleasant paræsthesia of right side of face and in mouth. No pain or hyperæsthesias. Mentally, no deterioration. Patient decided to try operation.

Operation by Dr. H. G. Mudd, March 25, 1902. Opening in skull about two inches in diameter. Before incision of dura, unusual resistance in pressing towards median line. After incision and careful palpation, a circumscribed firmness deep in substance of cerebellum. Cerebellum was incised; tumor plainly visible, smooth appearance, grayish tint. Operator introduced left index and with right hand a loop-end curette, grasped tumor gently and lifted it out. Attached only by frail, soft fibres, no resistance. Surrounding tissue carefully explored, nothing else found.

Size of tumor sparrow's egg, quite firm. Pronounced by Dr. Sidney Schwab a conglomerate tubercular growth.

One month after, some improvement; two months after, considerable anæsthesia of right conjunctiva. Speech and locomotion better. Better control of right arm and hand movements. Bulging at site of operation increasing in size and sensitiveness.

April 6, 1903. Patient says lump on back of head is larger, extends farther down; hand, arm, leg, right side jerky. Right ear deaf as ever; can eat only on left side; teeth coming out. Goes to work.

ADENOMA OF THE MUCOUS GLANDS OF THE LIPS AS A CAUSE OF MACROCHEILIA.

BY DANIEL N. EISENDRATH, M.D.,

OF CHICAGO,

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It has been recognized for a long time clinically that macrocheilia, or great thickening of the lips, can occur from one of two different causes, namely, inflammatory affections and the presence of genuine neoplasms. The former cause is by far the most frequent. It consists in an enormous thickening of either the upper or lower lip, or both, and occurs especially in scrofulous children, is very apt to relapse, and often very chronic in character. Microscopically, it consists of an hypertrophy of the mucous glands with an increase of all the tissues constituting the lip—that is, the connective tissue, blood-vessels, and so forth. It also occurs at times in syphilis. This condition, as has been just stated, is accompanied by an hypertrophy of the glands, but not by any great increase in their number.

Genuine tumors or neoplasms, which are primary in the lips, have been considered to be almost always of the nature of lymphangiomata, similar to a condition which occurs in the tongue,—macroglossia. In addition to the great increase in the number and size of the lymph vessels, this condition is accompanied by excessive connective-tissue formation and a moderate glandular hyperplasia. This glandular increase is, both in the case of inflammatory enlargements of the lips and in those due to lymphangioma, of a secondary nature and of a minor character.

Prior to a case reported by Fraenkel in the *Archiv für klinische Chirurgie,* Band xliv, 1892, macrocheilia, due to a



FIG. 1.—Double ptosis operated upon by Dr. W. O. Nance. Adenoma of labial glands (both lips) before operation. Operated upon by Dr. D. N. Eisendrath.



FIG. 2.—Bilateral ptosis and adenoma of labial glands (both lips) after operation.

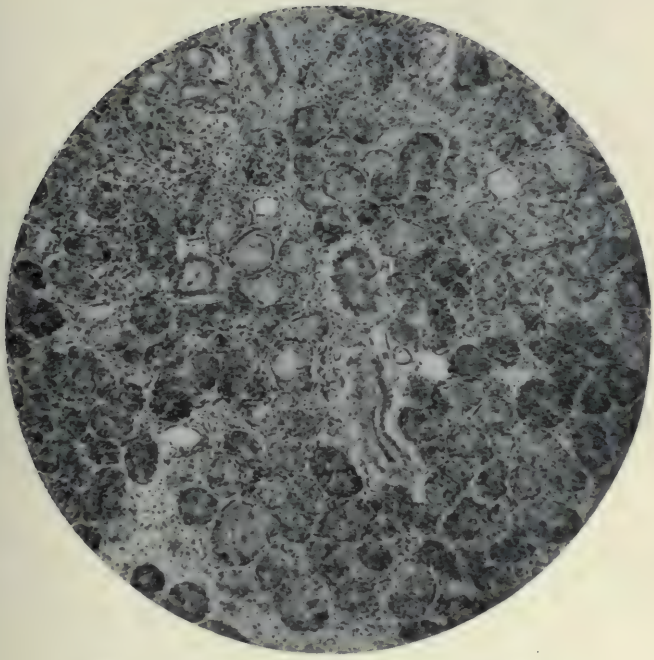


FIG. 3.—Microphotograph of adenoma of glands of lip.

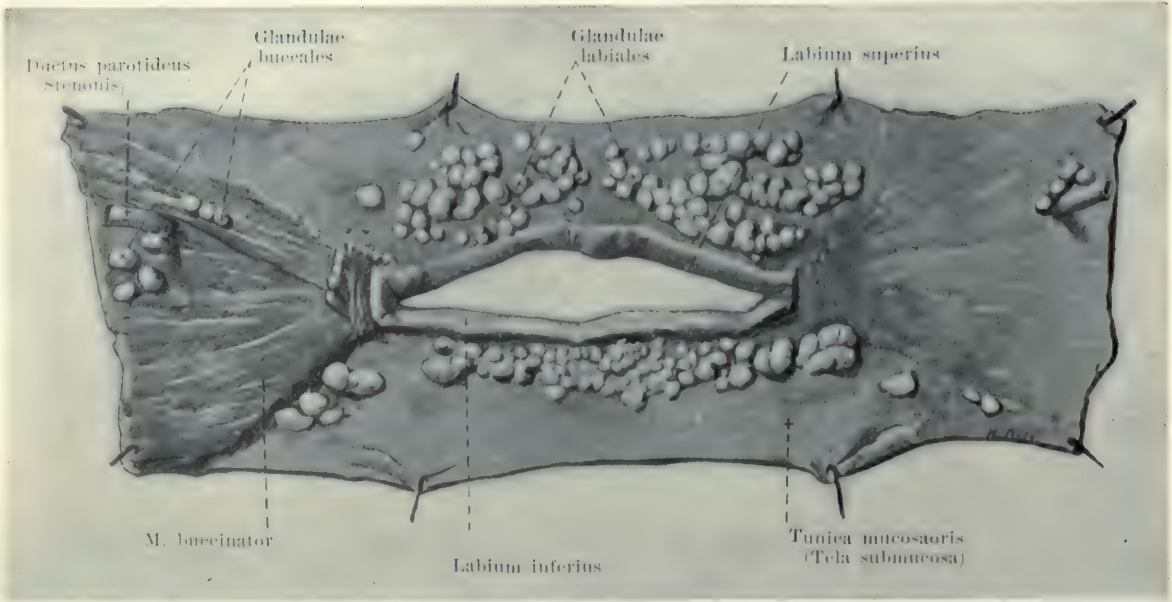


FIG. 4.—Normal distribution of mucous glands of lips. (Spalteholz.)

neoplasm of the mucous glands of the lips, was unknown. His case was that of a young man, nineteen years of age, who had noticed a steady increase in the size of the lower lip since he was four years old. It was accompanied by deformity of the jaw, which Fraenkel considered as being in a great measure responsible for the condition of the lip. There was no change in consistency and no signs of inflammation in the lip. The external appearance and findings at operation and microscopically so fully coincided with those of my own case that it will not be necessary to repeat them.

The case which I desire to report is that of a young man, sixteen years of age, who was referred to me in July, 1903, by Dr. W. O. Nance, of this city. He had arranged to have a double ptosis operated on by Dr. Nance, and desired at the same time to be rid of a disfiguring thickening and protrusion of both lips.

When he first consulted me in July, 1903, he gave the following history: He was sixteen years of age; had never suffered from any of the infectious diseases; was the only child, and had always enjoyed good health. Since the age of ten his parents had noticed a gradual, but quite marked, increase in the size of both lips. This had been rather stationary during the preceding year or two.

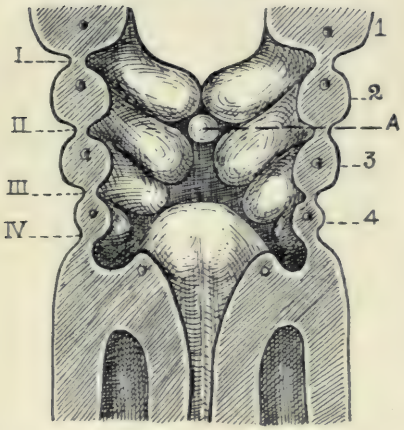
His appearance before operation is well shown in the accompanying photograph (Fig. 1). The protrusion of the upper lip was more marked than that of the lower. The skin covering the lip was smooth. There was no appearance of dilated vesicles upon the inner side. The lip was soft in consistency, not painful, and divided, as the picture shows, into two parts by a furrow corresponding to the position of the normal filtrum. My diagnosis at the time was a lymphangioma, for which I advised excision of as great an amount as possible, and treatment with hot-water injections and hot needle for the remainder. At the time of operation I was struck by the great vascularity of the parts, and upon attempting to excise a wedge-shaped portion of the lip was surprised to find that the greater portion of the thickening consisted of a number of little tumors from the size of a bird-shot to that of a pea, most of which were arranged in grape-like

manner in close relation to each other. Not having known at that time of Fraenkel's case, I interpreted these little masses to be either small lipomata or simply normal fat. After removing all of these little tumor masses, the mucous membrane was again sutured, and Fig. 2 will show the result in both the upper and lower lips. There has been a marked improvement in the cosmetic effect.

Microscopical examination of the tumors shows that they consisted uniformly of glandular tissue exactly resembling in type those of the normal mucous glands of the lips. As will be seen in Fig. 3, the appearance is that of a typical adenoma. The ducts are not dilated, and there is no tendency to cyst formation, as one might expect in inflammatory enlargement; nor is there any infiltration with leucocytes, or connective-tissue proliferation. Normally, the mucous glands are scattered, as shown in Fig. 4, along the inner side of both lips, lying in close proximity to the buccal mucous membrane. From the history and appearance of the lip at operation, and the examination of the tumors microscopically, the writer feels justified in calling the case one of neoplasm of a benign nature of the mucous glands of the lip. There has been no recurrence since operation.

This case is the second one which has ever been reported, so far as I can determine from a careful perusal of the literature, of adenoma of the mucous glands. The case is not only interesting from a diagnostic, but also from a prognostic, standpoint, owing to the fact that some of the cases diagnosed as epithelioma of the lip may prove on microscopical examination to be carcinomata of the glandular type arising from these glands.

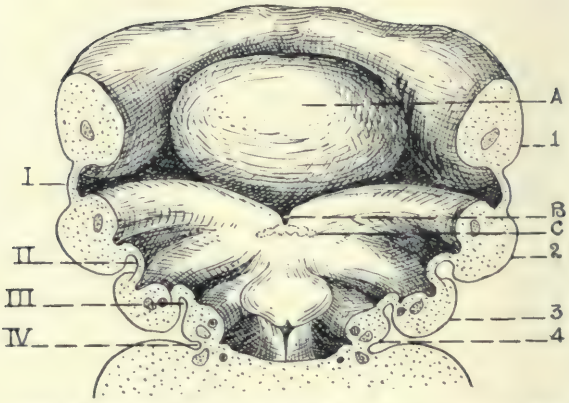
PLATE I.



Vertical section through the pharynx of a human embryo of 3.2 millimetres. *After His.*

1, 2, 3, 4. Branchial arches.
I, II, III, IV. Branchial clefts.
A. Tuberculum impar.

PLATE II.



Vertical section through the pharynx of a human embryo of 10 millimetres. *After His.*

1, 2, 3, 4 Branchial arches.
I, II, III, IV. Branchial clefts.
A. Tuberculum impar forming front portion of tongue.
B. Foramen cæcum.
C. Archage of thyroid gland.

LINGUAL GOITRE.

(ACCESSORY THYROIDS AT THE BASE OF THE TONGUE.)

BY HENRY R. STORRS,

OF BROOKLINE, MASS.

Definition.—The term goitre is a corruption of the Latin "guttur," meaning throat, and was formerly used to denote any swelling of whatever nature existing in the front of the neck. For a long time, however, the use of the word has been restricted to a swelling of one part, the thyroid gland. Lingual goitre is a tumor, consisting of normal or pathological thyroid tissue arising from one of the accessory thyroid glands which may be formed at the base of the tongue in the course of the development of the thyroglossal duct.

Embryology.—About the third week of embryonic life there appear near the end and on either side of the cephalic extremity of the embryo four protuberances or ridges extending obliquely downward and forward towards the ventral surface. These ridges are known as the branchial arches, and the intervening furrows the branchial clefts. These arches do not develop with the same rapidity, and if we examine an embryo at the end of the third week we find that while the first pair have grown so close that their ends have almost fused together, between the second, third, and fourth pairs there is a triangular space called by His the "mesobranchial space." At the top of this triangle between the first and second pair of arches a single tubercle is developed which His calls "tuberculum impar." This tubercle forms the front and main portion of the tongue, while the posterior part is made by the fused ends of the second and third pairs of branchial arches. (Plates I and II.) These three segments then grow gradually together, the two lateral halves of the posterior segment fusing together in the form of a V. Immediately behind

the tuberculum impar there appears a slight evagination of epithelium, which as it grows forms a pouch. The three segments of the tongue fusing together completely enclose this pouch, and we thus have a canal lined with epithelium leading downward from the apex of the V. This canal is named by His the " thyroglossal duct." This descends and eventually forms the isthmus of the thyroid body, the lateral lobes of this gland being derived " from the epithelium of the fourth gill clefts." About the fifth week the duct begins to atrophy, forming a fibrous cord, which passes from the dorsum of the tongue between the two geniohyoid muscles under the mylohyoid terminating in the isthmus of the thyroid body, and, in the course of time, this cord disappears, and we have nothing to show that the thyroglossal duct ever existed except a slight depression on the dorsum of the tongue, which is known as the " foramen cæcum." *

Sometimes, however, this entire obliteration does not occur, and we find in adults the whole or parts of the duct remaining. There may be a vestige left as a short tube leading from the isthmus of the thyroid upward or from the foramen cæcum downward to the hyoid bone. Bochdaleck, in a series of fifty subjects, has found in thirteen a canal anywhere from ten to fifteen millimetres in length, while His, Marshal, and others have also reported cases of the persistence of the duct.

It often happens that during the descent of the thyroglossal duct from the tuberculum impar small diverticula are formed, jutting out from the sides of the canal, and these may persist after the atrophy of the duct itself. The epithelium of these diverticula, which is the same as that lining the walls of the duct, or, in other words, is the embryonic tissue of the thy-

* I have followed the views of His as regards the embryological development of the thyroglossal duct and tongue. Late researches tend to show that the " tuberculum impar" does not alone form the forepart of the tongue, but that the greater portion is formed by outgrowths from the first pair of branchial arches. This would mean that the tongue is developed from four segments rather than three. See Verhandlungen der Anatomischer Gesellschaft, 1901, Vol. xv, pages 41, 42.

roid body, proliferates, and there are formed several masses of glandular tissue similar in structure to the thyroid body and known as accessory thyroid glands. It will readily be seen that these glands may be found anywhere between the foramen cæcum and the thyroid body, and, in fact, they are often found elsewhere in the body, Osler stating that there is a case on record of one occupying the whole right pleura (Osler, " Practice of Medicine," p. 836). For the sake of convenience, we may divide these glands into two classes,—those occurring above the hyoid bone and those below, and it is with the first of these classes that this paper deals.

Verneuil, in 1853, was the first to call attention to this subject. He says that, " while dissecting the insertions of the muscles of the tongue on the hyoid bone, a small glandular mass was exposed which was quite strongly adherent to the middle part of the superior border of this bone between the geniohyoid and genioglossus muscles. This mass was red, soft, and sessile, the size of a large pea, with a smooth, shining surface, and composed of a homogeneous tissue, which upon microscopic examination proved to be that of the thyroid gland." Since then much has been written concerning these glands by such investigators as Zuckerkandl, Kaydi, Grüber, Madelung, and others.

Their general characteristics when not in a pathological state may briefly be described as follows: their size may vary from that of a hemp-seed to a pea, while their contour is either round or ovoid, with a smooth or granular surface. They may be encapsulated and free in the deep muscles of the tongue; but, as a rule, they are attached to the hyoid bone by a kind of fibrous ligament which is supposed to be the remnant of the thyroglossal duct. Histologically, they resemble the thyroid body, and their function is probably the same as that gland, for, as I shall show later, extirpation of these glands has in some instances been followed by myxœdema. Their blood-supply is derived from branches of the lingual arteries.

Such, then, is the history in brief of the development of

accessory thyroid glands. As a rule, they cause no inconvenience and give rise to no symptoms, and a man may go through life unaware that there is anything abnormal about him. It is only when a pathological process is set up in one of these glands (I am speaking only of those at the base of the tongue) that the patient is aware of anything wrong and applies to a physician for relief, and it is then found that he is suffering from an affliction called by the French " Le goitre lingual."

That the disease is rather a rare one is shown by the fact that twenty-nine of the following cases are all, to the best of my knowledge, that have ever been reported. Through the kindness of Dr. S. J. Mixter and Dr. L. R. G. Crandon, I am able to report their two cases for the first time; while one other, that of Goris, is mentioned by Gaudier and Chevallier (*La Presse Oto-Laryngologique Belge*, January, 1903), making a total of thirty-two. It will be seen that the greater part of these have been published within the last fifteen years; and it is very probable that, while the disease may often have occurred, it is only of late years that the true nature of the growth has been recognized, and even then, in most cases, only after operation.

Case I.—*Congenital Tumor of the Base of the Tongue pressing down the Epiglottis on the Larynx and causing Death by Suffocation Sixteen Hours after Birth.* Hickman (*Transactions of London Pathological Society*, 1869, Vol. xx, p. 160).

On July 24, 1868, Mrs. C. was delivered of a girl after a normal labor at full term. The child at first appeared lifeless, making no attempt to cry or inspire, but, after being slapped and placed in a warm bath, respiration was got up, and continued all night in a feeble manner, interrupted by short gasps or sighs. No voice nor cry could be obtained. The next morning the breathing became so difficult that a doctor was sent for in haste. Putting his finger in the child's mouth, he found a large tumor projecting from the base of the tongue. It was impossible to see or feel the deep connections of the tumor, and no question of ligature or ex-

cision could then be entertained, and the child died in spite of all efforts at artificial respiration.

Autopsy showed that at the base of the tongue was a prominent, rounded, well-defined tumor about three-quarters of an inch from before backward, half an inch across and elevated nearly half an inch above the surface of the tongue. It was hard to the touch, and its surface was covered with the normal mucous membrane of the tongue. Its lower part was in contact with the epiglottis, pressing it over the rima glottis. Microscopic examination showed the tumor to consist of glandular follicles and be very rich in blood-vessels.

CASE II.—Case of Lucke, published by Merten (*Archiv für Anatomie und Physiologie,* 1879, p. 483).

Man, twenty-two years old; had had from childbirth a tumor near the hyoid bone. For the past year it had grown considerably and caused him much annoyance. The tumor was as large as a man's fist, was situated in the median line beneath the chin and could easily be felt in the mouth, while its base was in the root of the tongue. It was supposed to be a dermoid cyst, was removed through a vertical incision from the chin to the hyoid bone. There was no adherence to this bone. The patient had entirely recovered at the end of six weeks. Histological examination showed that the tumor was composed of thyroid tissue filled with colloid material.

CASE III.—*Tubular Adenoma of Root and Dorsum of Tongue.* Parker (*Transactions of London Pathological Society,* 1881, Vol. xxxii, p. 238).

Girl, sixteen and one-half years old; had a growth the size of a walnut projecting from root of tongue. It was hemispherical in shape, firm and slightly elastic, covered with stretched and ingested mucous membrane. Excised in June, 1877, a portion being left, which by December, 1878, had increased to half the size of the original tumor. By April, 1881, it had dwindled to half that again, the patient being well and not inconvenienced by it. Microscopical examination showed it to consist of glandular tubes lined with cubical epithelium, some containing plugs of gelatinous-looking material.

CASE IV.—*The Origin of the Foramen Cæcum Linguæ as shown by an Operation on a Rare Tumor of the Root of the*

Tongue. Bernays (*St. Louis Medical and Surgical Journal,* October, 1888, Vol. lv, p. 201).

Girl, aged seventeen; complained of having great difficulty in swallowing, and that her articulation was greatly impaired by a growth under her chin, which extended into her mouth and could be seen and felt on the back part of the root of her tongue. The tumor consisted of two parts (Plate III), one as large as a bantam's egg, the other the size of a cherry. On the surface of the small tumor was a depression in the shape of a canal, about one-fourth of an inch deep, which corresponded to the foramen cæcum. The upper lobe of the tumor projected into the pharyngeal cavity and was covered by mucous membrane, only the other half lay between the muscles of the tongue, bulging out at the submental surface.

Operation consisted of a median incision from the inferior maxilla to the hyoid bone, through which the tumors were easily enucleated. They had a thin, well-developed connective-tissue capsule. Complete recovery in fourteen days. Microscopical structure proved it to be nearly normal thyroid gland tissue.

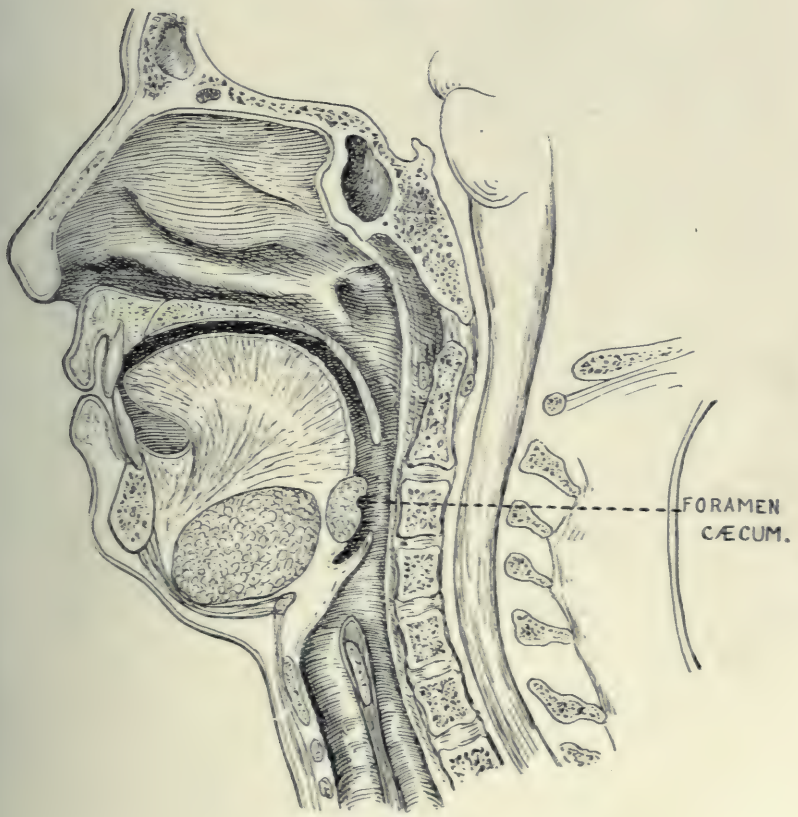
Case V.—*Accessory Thyroid at the Base of the Tongue.* Wolf (*Archiv für klinische Chirurgie,* 1889, Vol. xxxix, p. 224).

Girl of eighteen; had complained since her twelfth year of a swelling in her throat immediately following an attack of whooping-cough, and she now had difficulty in swallowing. Simple inspection of the mouth showed nothing, but examination by the laryngoscope revealed on the left side of the base of the tongue a firm tumor about the size of a nut. Treatment with iodide at first relieved her symptoms, but the growth then suddenly began to increase in size, and one year after the patient was first seen she returned to the hospital. Tracheotomy was performed; an incision was made in the median line beneath the chin, the inferior maxilla divided, the lingual arteries tied, the tongue split, and the tumor enucleated. The tissue of the tumor proved to be that of the thyroid gland.

Cases VI, VII.—*Two Cases of Glandular Tumor of the Tongue.* Butlin (*Clinical Society's Transactions,* Vol. xxiii, p. 118, and *British Medical Journal,* December 1, 1894).

Female, aged thirty-two; had a tumor at base of tongue, which could easily be seen when the tongue was pulled out. Had noticed it for one year; was about the size of a hen's egg, round,

PLATE III.



Bernays' Case, No. IV.

smooth, covered with mucous membrane, and so elastic that, with the idea of its being a cyst, it was punctured with the result that there was a free hæmorrhage for several minutes. Patient could speak clearly and swallow without much difficulty, but had been greatly afflicted with "sore throat." Operation March 6, 1889. Tracheotomy was performed and Hahn's tube inserted. The tongue was pulled out and the tumor removed. It did not appear to be very deeply embedded in the tissue of the tongue. It appears that all of the tissue of the tumor was not removed, and by the following June it had grown to be as large as a small bantam's egg. There was no return of the symptoms, and later the growth subsided.

Female, twenty-two; for four years had occasionally vomited blood. Two years previously had noticed a swelling at base of tongue, which her doctor had lanced with much bleeding. For nine months she had had great difficulty in speaking and swallowing. Examination showed that the tumor was identical with that described in the previous case, except that it was slightly smaller. Tumor was partly removed by means of a large galvanocautery loop. There was a slight return of the growth, but not enough to give rise to any inconvenience.

Sections of both tumors showed them to be "cystic tubular adenomata" of thyroid origin.

CASE VIII.—Staelin (*Jahrbücher de Hamburgischer Staats-Krankenhaus*, 1891–92, p. 413) reports an autopsy on a woman of seventy-seven years where a tumor as large as a walnut was found in the middle of the base of the tongue. It was of hard consistency, covered with normal mucous membrane, and buried in the muscles of the tongue. The tumor proved to consist of normal thyroid tissue.

CASE IX.—*Case of Enlarged Accessory Thyroid Gland at the Base of the Tongue.* J. Collins Warren (*American Journal of the Medical Sciences*, 1892, Vol. civ, p. 377).

Female, fifty-two years of age; had first noticed lump in throat in 1870, when she was suffering from "bronchial" trouble. Since then it has slowly been growing in size. During an attack of grippe in 1892 "the tumor became swollen and inflamed, and after that the lump seemed to settle back in the windpipe, and has since caused considerable irritation, obliging her to hawk and spit constantly."

Examination showed a tumor about the size of a hen's egg, situated upon the base of the tongue, covered with normal mucous membrane, upon which ran a tortuous vessel of considerable size.

Operation.—The tongue was drawn forward by means of one ligature passed through its tip and two passed through the dorsum of the tongue on either side of the growth. The tumor was then easily enucleated through a median incision. The redundant mucous membrane was excised on either side and the edges of the wound brought together with catgut sutures. Three vessels required ligature, one of them being of considerable size. Patient made an uninterrupted recovery, and there was no return of the tumor. Dr. W. F. Whitney reported the structure to be that of the thyroid gland.

Dr. Warren also states that he has twice before seen tumors at the dorsum of the tongue which were probably of the same nature. One was removed at the Massachusetts General Hospital in the early seventies, and " consisted of tissue closely resembling that of the thyroid gland." The other occurred in a young girl of twenty-one, and was " about the size of the last phalanx of the ring-finger." It gave but little trouble. There was no operation, and the patient was lost sight of.

Case X.—*Accessory Thyroid at the Base of the Tongue.* Galish (*Deutsche Zeitschrift für Chirurgie,* 1894, Vol. xxxix, p. 560).

Female, twenty-four years of age; had a tumor the size of a walnut between the hyoid bone and inferior maxilla situated in the median line. She had first noticed it four months previously, when it appeared like a small nodule. This tumor was excised and found to be an accessory thyroid. One year later, after a noon meal, the patient had the sensation of a foreign body in her throat, and rejected in a fit of coughing about a half a pint of dark blood. Repeated hæmorrhages followed, but without effort, cough, or vomiting, the patient losing about a quart and a half of blood. A diagnosis of hæmatopsis was made and patient sent to hospital, where she had repeated hæmorrhages for several days, but without cough. She had no trouble in breathing, but her voice was considerably changed. Simple examination of the mouth showed nothing, but by means of a laryngoscope a tumor was seen attached to the base of the tongue, round, the size of a cherry, covered with a deeply injected mucous membrane. It was so

elastic that, deeming it to be a cyst, a puncture was made, which only resulted in a hæmorrhage.

Operation.—Tracheotomy and a T-shaped incision, the horizontal part of which was between the two rami of the lower jaw and the vertical in a median line, dividing in halves the hyoid bone. The tumor was enucleated, accompanied by much hæmorrhage. The patient had a rapid recovery, and there was no return. Thyroid gland was not enlarged. Tumor consisted of thyroid tissue very rich in blood-vessels.

Case XI.—Baber, October 10, 1894, reported to the Society of Laryngology at London a case of a young girl of sixteen who had been troubled for nine months with a swelling at the base of the tongue. It was removed with a galvanocautery loop, but soon reappeared. It proved to be of thyroid tissue without cysts.

Case XII.—*Case of Accessory Thyroid Gland projecting into the Mouth.* Bond reported by McIlraith (*British Medical Journal,* December 1, 1894).

Girl, seventeen years old; complained of a lump at the back of the tongue. Had noticed it for two months. It gave no trouble, except that her voice was a trifle thick. Examination showed a tumor the size of a walnut situated close to the foramen cæcum. It was semielastic and immovable on the deep tissues of the tongue. The thyroid was normal.

Operation.—Mucous membrane round about tumor was cut with a pair of curved scissors. It was then fixed with a pair of tenaculum forceps and removed with the aid of a raspatory and a Mackenzie's polypus snare. There was profuse bleeding, which was controlled by pressure at the base with a finger, round which a piece of lint steeped in turpentine was wrapped. Wound healed in ten days. The structure of the tumor was that of the thyroid gland.

Case XIII.—*Accessory Thyroid at the Base of the Tongue.* Lympius (*Deutsche Zeitschrift für Chirurgie,* 1897, Vol. xliv, p. 451).

Female, aged thirty-four; had had for two years a swelling at the base of the tongue, which had steadily increased in size and gave difficulty in speaking and swallowing. For some years she had had a sensation of suffocation and hoarseness. In April, 1894, there was a hæmorrhage followed by an increase in the size of the tumor. In June it was lanced by a doctor, profuse bleeding

followed. When she entered the hospital the patient spoke as if she had a "billiard-ball" in her mouth and swallowed frequently. A tumor as large as a walnut was seen at the base of the tongue, firm to the touch, covered with blood-vessels, and pressing down upon the epiglottis.

Operation.—Tracheotomy was performed and the mouth kept open with a gag, the palatoglossal muscles incised, the tongue drawn forward, and tumor enucleated, accompanied by a severe hæmorrhage. There was complete recovery and no return of the growth. Tumor consisted of very vascular thyroid tissue.

Case XIV.—*Accessory Thyroid at Base of Tongue. Myxœdema after Removal.* Seldowitsch (*Centralblatt von Chirurgie,* 1897, p. 499).

Girl, fourteen years old; had swelling at base of tongue near the foramen cæcum; was round, smooth, firm, the size of a cherry, projecting on the dorsum of the tongue and causing considerable annoyance. Patient was unaware how long it had been there. Tumor was removed with a galvanocautery loop and proved to be of thyroid structure.

Patient returned to the hospital in six months with all the symptoms of myxœdema. The thyroid could not be felt.

Case XV.—*Goitre at the Base of the Tongue, Myxœdema following Operation.* Kraske reported by Von Chamisso (*Beiträge zur klinischen Chirurgie,* 1897, Vol. xix, p. 281.)

Woman, thirty-seven years old; afflicted with cretinism and complete absence of thyroid body; complained of trouble in speech, deglutition and respiration. On the base of the tongue, slightly to the right of the median line, was a swelling as large as a walnut, with a smooth surface covered with large vessels. To the touch part was firm and part fluctuating.

Operation.—Tracheotomy, traction forward on the tongue and enucleation. Structure was in part that of embryonic thyroid tissue and partly that of ordinary goitre with colloid degeneration. Patient returned in four months with symptoms of myxœdema, and was treated with thyroid extract.

Case XVI.—Reintjes, of Nymegen, on May 23, 1898, reported a case of lingual goitre to the Society of Laryngologie, Rhinologie, and Otologie of Holland. It occurred in the case of a man twenty-five years old, who was troubled with severe hæmorrhages. These were without apparent cause and were not accom-

panied by vomiting or coughing, but sometimes followed the swallowing of a large mouthful of food. At the base of the tongue could be seen a swelling. It was of dark brown color, smooth and elastic to the touch, and covered with large veins.

Operation.—Tracheotomy, traction forward on the tongue, the anterior pillar of the fauces divided, capsule of tumor split horizontally, and tumor shelled out. Tumor consisted of thyroid substance.

CASE XVII.—Treitel, before the Berlin Medical Society, May 25, 1898, reported a case of presumable lingual goitre which had existed for twenty years in a woman. The symptoms were slight, only occasional trouble in swallowing. There was no operation.

CASE XVIII.—Benjamins (*Nederl Tijdsch voor genesk,* 1899) reports a case of goitre at the base of the tongue occurring in a man. There was absence of the true thyroid. Operation was followed by symptoms of myxœdema.

CASE XIX.—Posthumus Meyjes read before the Society of Otologie and Laryngologie of Belgium, June 4, 1899, a case of a woman of twenty-four years who since childhood had had the sensation "as if there were a potato stuck in her throat." From time to time she spat up bloody pieces of mucus. Examination showed a tumor occupying the right half of the base of the tongue, protruding 2.5 centimetres, round, smooth, not painful, immovable, and covered with dilated vessels. No true thyroid could be felt. There was no operation.

CASES XX, XXI.—*Two Cases of Accessory Thyroid Tumors at the Base of the Tongue.* Schadle (*Journal of American Medical Association,* August 12, 1899, Vol. xxxiii, p. 386).

Woman, twenty-five years of age; had noticed for the past six months a growth at the base of her tongue. The condition caused her more mental annoyance than physical discomfort. Menstrual function had been rather irregular of late. Respiration and deglutition were not interferred with, but impairment of speech was noticeable, the voice being thick and not resonant. Examination showed the growth to be the size of an English walnut, covered with mucous membrane, which showed an intense superficial vascularity, of a deep purplish red color, hard, and immovable. Exploratory puncture was followed by copious bleeding. For two months electrolysis was employed, with the

result that the tumor was reduced to one-third of its original size. During the time of the apparently suppressed menstrual function, the lingual tumor would swell and become very vascular, —a very peculiar phenomenon. Several violent hæmorrhages then occurred, and an operation was advised and performed by Dr. McBurney. The tumor was enucleated through an incision extending from the symphysis menti to the hyoid bone. There was considerable hæmorrhage and no return of the tumor.

Its structure was that of the thyroid gland.

The second case was that of a woman, twenty-three years old, who had noticed a growth upon the base of her tongue for ten years. Her voice had entirely lost its resonance, she had some difficulty in swallowing, and a shallow, resistant cough. Inspection showed a tumor situated at the base of the tongue anterior to the epiglottis. It was smooth, dense, of a dusky red color, with a characteristic resilient feel, and appeared perfectly homogeneous. Operation was refused, but the characteristics of this tumor were so typical that we can safely call this an accessory thyroid.

Case XXII.—Dr. Holmes (same reference) reported a case in every respect similar to that of Dr. Schadle. In this case the tumor was partly removed by the galvanocautery.

Cases XXIII, XXIV.—*Two Cases of Accessory Thyroid Glands at the Base of the Tongue.* Watson (*New York Medical Journal,* Vol. lxx, p. 579, October 21, 1899).

Woman, fifty years of age; complained of great dyspnœa and difficulty in swallowing. She stated that there had been a lump in her throat for the past ten years, which had given little trouble until recently, when it had begun to enlarge. Examination showed a smooth tumor at the base of the tongue pressing back upon the epiglottis. It was about an inch and a half long, one inch wide, and an inch thick; it was smooth and firm, with an ulcerated top, the ulcer being covered by a white slough or membrane. Part of the tumor was removed with the galvanocautery loop. Structure was that of a degenerated thyroid body.

The second case was that of a colored girl sixteen years old. There had been a "lump in her throat" for five years, which had lately interfered with her swallowing. Examination showed a growth in every way similar to that of the previous case, except that it was not ulcerated. Tumor was removed with the galvanocautery snare. Structure was that of the thyroid gland.

CASE XXV.—*Thyroid Tumor at the Base of the Tongue.* Vallas (*Revue de Chirurgie,* May 10, 1900).

Young girl of twenty years; complained of difficulty in swallowing; the tone of her voice was altered and resembled the voice of patients with ranula. Examination showed a tumor the size of a small nut situated behind the foramen cæcum on the dorsum of the tongue, elastic, and not painful upon pressure. Diagnosis of cyst of the thyroglossal canal was made.

Operation.—Incision was made above the hyoid bone to the right of median line, and a puncture made into the mouth through the tumor. Drainage was established, and the wound healed well; the patient left the hospital much improved. Six months later she returned, saying that as soon as the drainage gauze had been removed the tumor had begun to grow. This time a median incision was made, the hyoid bone divided, the fibres of the mylohyoid separated, and whole tumor easily enucleated. There was no return. Histological examination showed structure of the thyroid gland.

CASE XXVI.—*Case of Accessory Thyroid Tumor at the Base of the Tongue.* Theisen (*Albany Medical Annals,* 1901, Vol. xxii, p. 537).

Tumor occurred in a woman sixty-seven years old, and was identical in every way with those of Dr. Warren and Dr. Schadle. Owing to the age and condition of the patient, operation was not advised. In this case the patient, when quite young, had a well-marked goitre, now the thyroid cannot be felt. The tumor also appears larger at times than others.

CASE XXVII.—*A Case of Lingual Goitre.* Curtis and Gaudier (*Revue Hebdomadaire de Laryngologie, Otologie, et de Rhinologie,* Vol. xxiii, p. 417, April 12, 1902).

Young woman of twenty-one years; complained of difficulty in swallowing and talking. Her voice had a nasal quality, not very sonorous, often hoarse or muffled. She had had a growth on her tongue for five years. This had been partially cut and cauterized two years previously, but lately had returned. Examination with a laryngoscope showed behind the lingual V a round tumor, the size of a large nut, covered with normal mucous membrane and a fine net-work of vessels. It was of elastic, almost soft, consistency, and seemed firmly embedded in the muscles of the tongue. The thyroid body was small and the lymph glands normal.

Diagnosis of lipoma or liposarcoma.

Operation.—The mouth was kept open by a gag, a silk suture passed through the tongue, which was then drawn forward as far as possible. Another strong silk suture was then passed under the mass of the tumor and well within the normal tissue of the tongue. This suture not only assisted in drawing out the tongue, but after operation acted as a hæmostat, and allowed the edges of the wound to be quickly approximated. The tumor was then enucleated through a median incision of its mucous membrane covering. There was profuse bleeding. Recovery was complete and there was no return of the growth. The structure of the tumor was that of a typical thyroid gland.

CASE XXVIII.—*Accessory Thyroid Tumor situated at the Base of the Tongue.* Winslow ("American Medicine," December 13, 1902).

Girl, aged seventeen; complained of having difficulty in swallowing. Had always been troubled with sore throat, and her voice was muffled and indistinct. Examination showed an ovoid mass about half the size of a hen's egg upon the base of the tongue between the foramen cæcum and the epiglottis. It was smooth, covered with mucous membrane, and somewhat elastic to the touch.

Operation.—The growth was thought to be too large to remove through the mouth, and was enucleated through a median incision from the chin to the hyoid bone. Wound healed by first intention. Structure of tumor was that of the thyroid gland.

CASE XXIX.—*Thyroid Tumor at the Base of the Tongue.* Gaudier and Chevallier (*La Presse Oto-Laryngologique Belge,* January, 1903).

This occurred in a girl twenty years old. It had existed for three years, and was in every way identical with the previous case reported (Case XXVII). This time, as the patient's tongue was very short and plump and the tumor very far back, it was decided to operate by incision through the hyoid bone, as described in Case XXV (Vallas). A median incision was made, the hyoid bone divided, and the tumor enucleated. As no normal thyroid body had been found, it was thought best to leave a small section of the gland in order to avoid the after appearance of myxœdema. Complete recovery. Section of tumor showed thyroid tissue.

CASE XXX.—The same authors cite a case of Goris which

has never been published, in which the removal of a lingual goitre was followed by myxœdema. In this case operation was through the mouth, and the tongue was cut from its anterior insertions in order that it might be drawn forward.

CASE XXXI.—*Accessory Thyroid at Base of Tongue.* S. J. Mixter (Massachusetts General Hospital, August 9, 1895).

Female, age twenty-four; had noticed a swelling on back of tongue for three weeks, which had not given any inconvenience in swallowing or talking. There was no pain. Examination showed a mass about the size of a small hickory nut on the dorsum of the tongue. Another, about the same size, can be felt under the symphysis of the jaw.

Operation.—Incision in the median line of neck two inches long and tumor shelled out. Growth was the size of a white grape and connected with the thyroid. Other tumor was removed through the mouth by an operation similar to Dr. Warren's case, No. IX. Tumor consisted of thyroid tissue. Recovery was complete.

CASE XXXII.—Dr. L. R. G. Crandon had as a patient a young girl, nine years of age, who had noticed a growth in her throat for one and a half years. She complained of having great difficulty in breathing while in bed. She was unable to assume a recumbent position and was obliged to sleep while sitting propped up with pillows. A year ago she consulted a throat specialist, and an attempt was made to remove the tumor. Such a profuse hæmorrhage occurred that the operation was stopped. Examination showed a growth about the size of a nut situated at the base of the tongue, ovoid in shape, covered with smooth membrane and elastic to the touch. (Plates VI, VII, VIII drawn from life.) The case has not yet come to operation.

Etiology and Evolution.—The most striking etiological fact regarding lingual goitre is its occurrence among women rather than men. Thus, out of thirty-two cases we have but three occurring in men, namely, those of Lucke, Reintjes, and Benjamins. In this respect the affection is similar to the more ordinary forms of goitre which are found much more frequently in women than in men. Why this is so has never been satisfactorily explained.

Grüber states that in a series of 300 subjects with superior accessory thyroid glands, 250 were men and fifty were women, and again, out of twenty-three other cases, eighteen were men and five women. These figures show that accessory thyroids occur overwhelmingly more frequently in men than in women, and yet we find that in women they develop into tumors and give rise to lingual goitre in the proportion of twenty-nine to three. Why is this? It is a question that cannot be answered at the present time, and a dense cloud of obscurity hangs over the etiology and pathogenesis of all forms of goitre.

Lingual goitre may occur in patients at any period of life. Thus, in the case of Hickman, we find it occurring in a new-born child, while in the autopsy reported by Staelin the subject was a woman of seventy-seven years.

It is, however, generally to be found in women between the ages of fifteen and forty. There is no reason to doubt but that the accessory thyroids at the base of the tongue may undergo the same morbid processes as the thyroid body itself in a case of ordinary goitre. In some cases we find that these lingual glands, in the absence of a normal thyroid body, have undergone a compensatory hypertrophy, and have taken up the function of the thyroid itself, so that after extirpation the symptoms of myxœdema have appeared (cases of Seldowitsch, Kraske, Benjamins, Meyjes, and Goris).

The evolution of lingual goitre is like its etiology, not well understood. In most of the cases, the presence of the growth had been perceived for a long time without any inconvenience arising from it. Then all at once the tumor begins to grow, and we have a chain of serious symptoms. What is the reason for this long latent period and sudden eventual quick development? In but two cases is there any specific cause stated. Dr. Warren's patient, who had noticed the growth for twenty years, said that during an attack of grippe the tumor became swollen and inflamed, and after that "the lump seemed to settle back in the windpipe," and then caused considerable irritation, obliging her to "hawk and spit con-

PLATE IV.

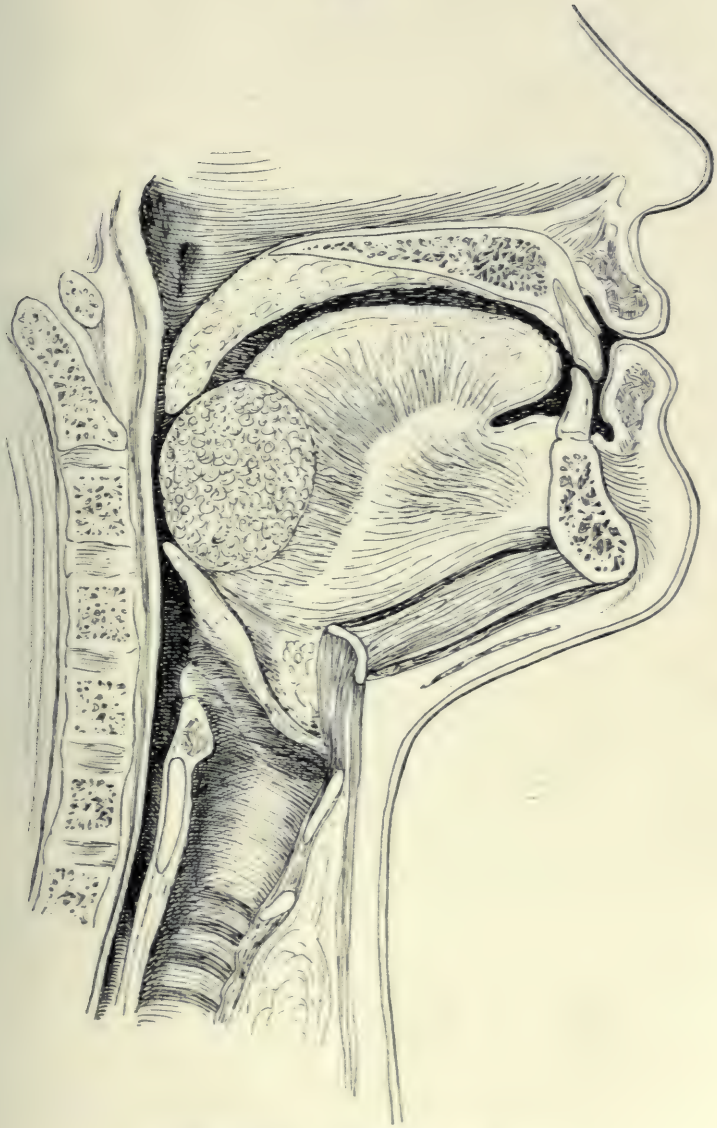


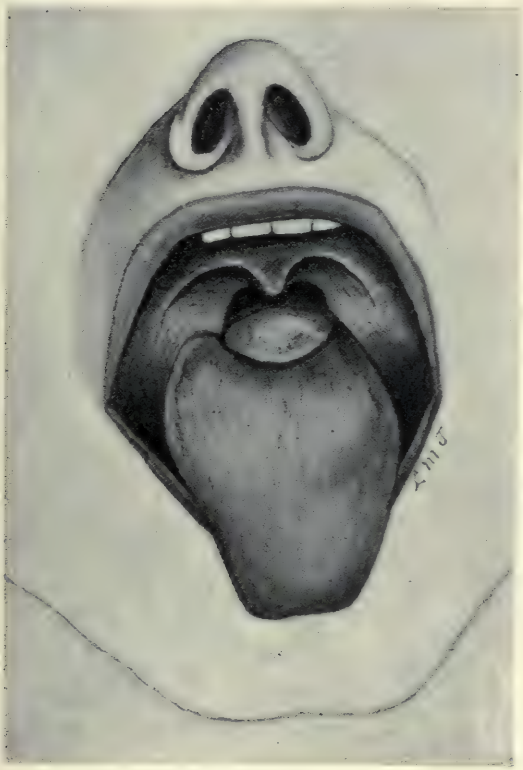
Diagram showing typical situation of tumor.

PLATE V.



View through mouth with tongue drawn forward showing the vessels on surface of tumor.

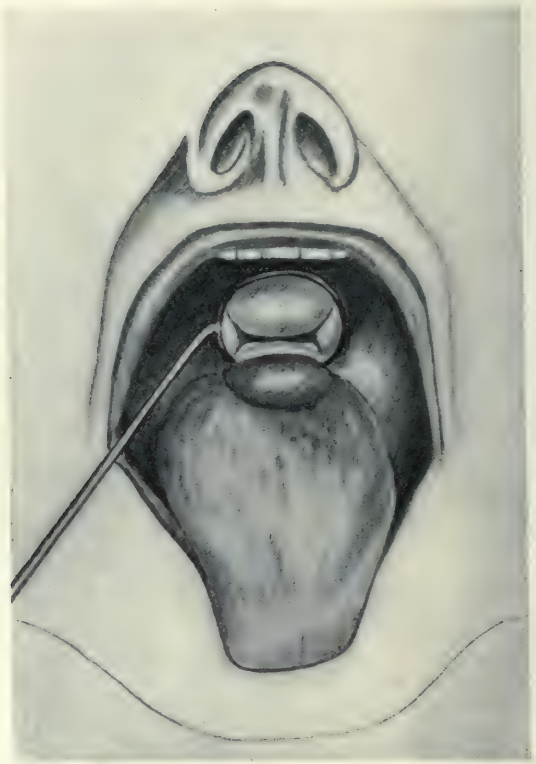
PLATE VI.



Showing appearance of tumor in mouth.

Unpublished case of Dr. Crandon, Case XXXII.

PLATE VII.



Laryngoscopic view.

PLATE VIII.



Rear view, showing tongue, tumor, and epiglottis.
VI and VII drawn from life; VIII, constructed.

tinually." In Wolf's case the patient first noticed the growth after an attack of whooping-cough, but in both of these cases we cannot call the grippe and whooping-cough the specific causes of the tumors, and in all probability it is a simple coincidence that the one followed on the heels of the other. It is very likely that puberty plays an important rôle in the development of these growths, as it appears to do in that of normal thyroids.

Pathological Anatomy.—These lingual tumors present in the main the same macroscopical appearances. They are situated upon the dorsum of the tongue, generally just behind and below the foramen cæcum, but sometimes enclosing it in their growth (Bernays), on the median line, as a rule, but perhaps a little to the right or left. In shape they are round or ovoid, while their volume is quite variable, ranging from the size of a cherry or small nut to a man's fist. The tumor is encapsulated and may project markedly about the surface of the tongue, or be almost buried in the muscles of this organ. In either case there is no inflammation or infiltration of the surrounding tissues, and at operation the tumor has in most cases been easily enucleated. (Plate IV.) Its surface is covered with the mucous membrane of the tongue, and in only one case (Watson) has there been any ulceration. It is smooth and shining, and in color is darker than that of the surrounding mucous membrane, due to the great infiltration of blood-vessels which is always to be seen. These vessels not only cover the surface of the goitre, but penetrate deeply into its tissue and cause the profuse hæmorrhages which occur at operation. This rich vascularization is a striking and characteristic feature of lingual goitre, and is of great value in differential diagnosis.

The tumor may or may not be movable. This depends upon its age, size, and the depth to which it has penetrated the muscles of the tongue. Its consistency is very variable. We may find a firm, elastic mass or a soft and fluctuating one. This variability depends upon the structure of the tissue of the tumor. Thus, in Bernays's case the growth consisted of

almost normal thyroid tissue. In Warren's there was colloid degeneration; then, again, in that of Kraske the tubules were full of embryonic thyroid cells; and still again we find the formation of cysts containing yellowish transparent fluid. (Gaudier and Chevallier.)

Symptoms.—The presence of lingual goitre is marked by a variety of symptoms. The troubles caused by it are purely functional, and these vary with the size of the tumor. In but one case do we find any constitutional symptoms present; in all the others the patients appeared to be in the best of health. This single case is the first of those reported by Schadle in a woman of twenty-five. He states, "she was anæmic and the muscles soft and flabby. Evidences of malnutrition and nervous exhaustion were marked. She complained of insomnia and gastric derangement. A heavily coated tongue, loss of appetite, constipation, and distressing flatulency of the bowels were pronounced symptoms." There is. however. no reason to connect this set of symptoms with the growth on the back of the tongue, except in so far as to produce an excessive amount of mental worry.

The size and the situation of the tumor determine the severity of the symptoms. It may be as large as a walnut, and yet cause no inconvenience (Staelin), and again may be the size of a cherry, and yet be so situated that by projecting into the pharynx cause serious trouble. The symptoms are those such as would be produced mechanically by any foreign body, and with one exception are not at all pathognomonic, but are characteristic of all tumors of the tongue which mechanically obstruct the entrance to the œsophagus or trachea.

The patient may be aware of the growth for many years without being inconvenienced by it. The first symptom is generally an uncomfortable feeling at the base of the tongue, a fulness in the throat, accompanied by a frequent desire to swallow. The voice then begins to change. It may be simply thick or nasal in quality, or it may entirely lose its resonance and be muffled and dead. Deglutition is often seriously inter-

fered with, the patient finding it quite painful to swallow. There may be increased salivation, and fits of coughing due to irritation of the salivary glands and epiglottis. The respiration is troubled only in the cases of the largest tumors, or where the situation is low down enough so that the tumor presses the epiglottis over the rima glottidis, and this may be marked enough to cause death by suffocation. (Hickman.) The one symptom characteristic of lingual goitre, and upon which great stress should be laid, is the occurrence of profuse hæmorrhages. These occur at any time and without any apparent cause. They are unaccompanied by coughing, vomiting, or pain, and the patient is simply aware that her mouth is filled with fluid, which on expectoration proves to be blood. These hæmorrhages are due to the rupture of one of the many vessels covering the mucous membrane of the growth. (Plate V.) The mucous membrane is very thin, and is continually being torn by bits of food passing into the œsophagus or by constant rubbing against the epiglottis and posterior wall of the pharynx.

Examination of the mouth may result in nothing being seen, and, even when the tongue is drawn out as far as possible, the growth may not be visible, and its presence can only be determined by the use of the laryngoscope. By this means the general characteristics of the growth may be distinctly made out, and then with the finger its outline, consistency, and the lack of pain on pressure may be further ascertained. In only one case (Bernays) has there been any swelling beneath the jaw; but if there exists a large tumor, it may be felt upon deep palpation just below the inferior maxilla. It is especially important to discover, if possible, by palpation the presence or absence of the normal thyroid, in order to avoid the possibility of myxœdema following operation.

Diagnosis.—The diagnosis of lingual goitre is not always easy unless we have present the typical chain of symptoms. If the patient, especially if a woman, complains of a lump in her throat that has existed there for several years with no incon-

venience, that it has lately begun to grow, causing a change in her voice, trouble in breathing and deglutition, and especially if she complains of frequent hæmorrhages unaccompanied by cough or vomiting, and if, upon examination, a round, elastic tumor with a deeply injected mucous membrane is found at the base of the tongue, we are led at once to think of lingual goitre. Oftentimes the presence of hæmorrhages from the mouth is the only symptom; and if this is the case, we must rule out diseases of the lungs and stomach by physical examination and exclusion. The former can be ruled out by the absence of cough and the latter by absence of vomiting.

Given, then, a tumor at the base of the tongue, the main point in differential diagnosis is as to whether it is benign or malignant, in order that an operation exceeding the requirements of the case be not performed. The slow growth of the tumor, the long latent period, and the sudden development, absence of pain, and infiltration of the surrounding tissues, absence of enlargement of the cervical glands and the general good condition of the patient, all point towards a benign growth. Furthermore,

Sarcoma grows to a considerable size rapidly, is painful, and can only be confounded with lingual goitre in the beginning, when it is simply an indurated nodule.

Carcinoma is not, as a rule, seen until late in life, is almost always ulcerated, is painful, and produces a very fetid secretion.

Granted, then, that we have a benign growth, what is its nature?

Lipoma is quite soft, presenting more the appearance of a cyst than a goitre. Its golden yellow color can be seen shining through the mucous membrane covering, which is usually quite loose. It is, moreover, quite rarely to be found at the base of the tongue, its more common situation being in the middle or tip of this organ.

Angioma is quite common at the base of the tongue. It may be covered with tortuous vessels and give rise to hæmor-

rhages, but its color is violet or bluish black, and is quite easily reduced upon pressure, immediately filling again.

Fibroma, pure or mixed with fatty, bony, or cartilaginous elements, may be found in the tongue; but it tends to become pediculated quite quickly, and presents the appearance of a polypoid growth.

Syphilitic Gumma grows in a different manner. It tends to ulcerate quickly, is often multiple, is not sharply defined; its mucous membrane covering is not deeply injected, and it is accompanied by other manifestations of syphilis.

Hypertrophy of the Lingual Tonsils is not very frequent; it is a superficial swelling only, and consists of whitish, yellow, hard concretions, which distend the crypts of the lymph follicles and project from the surface of the tongue.

Cysts may occupy the same position as goitre at the base of the tongue, but, as a general rule, they are softer and more fluctuating. If the goitre has undergone cystic degeneration, the differentiation is more difficult. The color of a cyst differs, being yellow or brownish; its surface is not so markedly covered with vessels, while the membrane covering itself is thinner and more transparent. Dermoid cysts may greatly resemble goitre, but their growth is more rapid; there is no latent period; their color is yellow; they lack vascularity, and pit upon pressure.

Prognosis and Treatment.—The prognosis of lingual goitre is favorable. There have been no postoperative deaths, and in all cases that have come to operation the cure has been permanent. Medicinal attempts to cure the disease have been of little avail. Iodide seems to have a slight effect in reducing the growth, but its action is slow and rather ineffectual. Counter-irritation with iodine has been tried, and caustics and electrolysis have been used, but none of these methods have proved satisfactory, especially as in most cases the patient does not apply to a physician for relief until the symptoms are so grave that a quick removal of the growth is imperative.

Simple puncture or puncture followed by injections of

chloride of zinc or tincture of iodine are not to be recommended. Puncture is, in all cases of goitre, followed by profuse bleeding, and sometimes by inflammation and a sudden increase in the size of the growth. Moreover, the only thing to be learned by puncture is as to whether or not the tumor contains fluid. In the first case, we transform the growth into a loose pouch, which is harder to enucleate than if it were full; and in the second we accomplish nothing, and moreover expose the patient to the danger of infection.

The only rational method of treatment then is removal. The two principal means for accomplishing this have been by the use of the galvanocautery loop (Butlin, Baber, Seldowitsch, Holmes, Watson) and by incision with enucleation (Butlin, Warren, McIlraith, Lympius, Kraske, Reintjes, Gaudier, Lucke, Bernays, Schadle, Winslow, Galish, Wolf, Vallas, Mixter).

The use of the galvanocautery loop has, on the whole, been rather unsatisfactory. In all the cases in which it has been used, parts of the tumor have been left, causing a slight return of the growth. This return has not been excessive, but it is to be regretted, unless rendered necessary by the absence of a true thyroid.

There remains then total enucleation. This is a comparatively easy operation, as the tumor is well defined and not adherent to the neighboring tissues. The base of the tongue may be reached in two ways, either through the buccal cavity or through an incision in the suprahyoid region, which may be simple or include the hyoid bone or inferior maxilla.

Enucleation through the mouth is the method chosen by Butlin, Warren, McIlraith, Lympius, Kraske, Reintjes, Gaudier, and Mixter. This operation is as follows. After etherization the jaws are kept open as far as possible by means of a gag; a silk ligature is then passed through the tip of the tongue for traction, and a second ligature passed through the muscles of the base of the tongue under and below the mass of the tumor. This second ligature renders traction on the tongue

quite easy, and after enucleation is of great assistance in controlling the hæmorrhage and in approximating the edges of the wound. The tongue is then drawn forward as far as possible until the tumor appears between the incisors, a longitudinal incision is made in the growth, and the tumor enucleated. The redundant mucous membrane on either side of the wound is then trimmed off and the edges brought together with catgut sutures. In some cases tracheotomy has been first performed, but this procedure does not seem to be indicated. The patient may be placed in Rose's position with the head extended over the edge of the table, and in this way the blood may be kept from running down into the trachea. It is well, also, to keep the pharynx as clean as possible by sponging it at intervals with some antiseptic solution.

The simple suprahyoid method has been used by Lucke, Bernays, Schadle, and Winslow. An incision is made from the symphysis menti to the hyoid bone in the median line, dividing all the structures down to the tumor, which can then be enucleated. The opening made in this manner is rather small; and if the tumor is at all large or situated rather high on the dorsum of the tongue, enucleation is rendered quite difficult. To overcome this trouble, Wolf first performed tracheotomy, made a median incision above the hyoid bone, ligatured the lingual arteries, divided the inferior maxilla, and split the tongue itself until he reached the tumor. This procedure gave a large opening in which to work, but the operation is too serious, too long, and too mutilating; it is, moreover, unnecessary, as the method employed by Galish, Vallas, and Gaudier accomplishes the same result and is much simpler. An incision is made in the median line from the chin to the superior angle of the thyroid cartilage. The hyoid bone is then denuded and divided in halves, and the incision carried through the mylohyoid and geniohyoid muscles to the tumor. After enucleation, the hyoid bone is sutured with silver wire and the muscles and skin with catgut, horsehair, or whatever is desired. The opening made in this manner is large and the wound heals easily and quickly.

The indications for each of these operations depend upon the size and situation of the tumor. The buccal method is easily the best when practicable. It is but a short operation, is simple, and leaves no scar, which is a great advantage when we consider that most of the patients are women. This method can be used when the patient's mouth is large, the tongue long and slender, and the tumor of not very great size and situated rather high on the base of the tongue. If the tumor is large and low, the patient's tongue thick and short, and the mouth small, then, if possible, it is best to use the simple suprahyoid incision. If the opening thus made is not large enough, then the hyoid bone may be divided.

CONCLUSIONS.

1. Lingual goitre is a tumor at the base of the tongue, arising from an accessory thyroid gland which may be found in the course of the development of the thyroglossal duct.

2. It has all the characteristics of ordinary goitre.

3. It occurs almost exclusively in women between the ages of fifteen and forty. It grows slowly, and may exist for years without causing any annoyance until some unknown cause stimulates its growth and produces symptoms. These are functional and not constitutional, and consist of trouble in swallowing, breathing, and speaking, accompanied by frequent hæmorrhages.

4. The tumor is round or ovoid, elastic, and covered with a very vascular mucous membrane, and is almost never ulcerated.

5. Dermoid cyst offers the only difficulty in differential diagnosis, but this is generally yellow, grows rapidly, pits on pressure, and has not the vascularity of goitre.

6. Operation is the only radical cure. There are two ways of reaching the tumor, namely, through the mouth and through an incision in the suprahyoid region, the former being the best.

7. The prognosis is good.

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PURULENT MASTOIDITIS.

SINUS THROMBOSIS; THREATENED CEREBRAL ABSCESS; RECOVERY AFTER OPERATION.

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THE patient, J. S., a boy of six years, was admitted to the Elder Cottage Hospital, Govan, on December 2, 1903, complaining of a "discharge from the ear" of considerable duration, together with, recently, pain and tenderness over the part, and slight headache.

On examination there was found to be a purulent discharge from the left ear; the left tympanic membrane was gone, and there was bare bone on the inner tympanic wall. There was tenderness to pressure over the mastoid region. Patient also complained slightly of tenderness on pressure over the course of the internal jugular vein, the tissues in that region being palpably thickened. The pupils were unequal, the left being slightly smaller than the right. Patient's intelligence was dulled, his answering being very slow. Temperature and pulse were both rather subnormal.

A diagnosis of suppurative mastoiditis, with septic sinus thrombosis at an early stage, without systemic involvement, and with encephalitis, threatening abscess formation, having been made, operation was decided on.

The parts were prepared, and the operation performed within twenty-four hours of my first seeing him.

For an hour or so prior to the operation, patient was noticed to be very drowsy, requiring to be roused to answer questions, and immediately dropping over to sleep again.

The radical mastoid operation was performed through a straight incision, immediately posterior to the pinna; the periosteum was reflected and the bone fully exposed. An opening was first made, through the suprameatal triangle, down to the mastoid antrum, when pus immediately welled up. The opening was en-

larged by a burr, and the antrum found full of pus. The mastoid region was now thoroughly opened up with the surgical engine, all the cells containing pus being cleared out, until, finally, smooth, healthy bone was exposed in all directions. The granulation tissue in the middle ear was also cleared out, the malleus and incus being removed. The facial canal was examined and found to be intact.

The cavity thus made having been thoroughly disinfected, the dura mater covering the temporosphenoidal lobe was exposed. It was found to be inflamed, and the vessels on its surface were engorged; but it was hoped that this condition might diminish with the removal of the cause, and the membranes were therefore, meanwhile, left intact.

The sigmoid sinus was next exposed. While the lumen of the sinus was not entirely occluded, its walls had completely lost their natural elasticity. The anterior wall in particular, which was bathed in pus, was very much thickened.

The surrounding parts having been thoroughly cleaned and disinfected, the wound was filled with iodoform and boracic powder and packed with iodoform gauze. A fine piece of iodoform gauze was also introduced through the external auditory meatus; then a dressing was applied, and the patient was returned to bed.

After the operation the temperature remained normal, and the pulse became more rapid (100–130). The left pupil remained slightly smaller than the right for two or three days after the operation. During this period patient was at times restless, at others drowsy, and he vomited several times. After this, however, he rapidly came round, and became bright and intelligent.

The dressing was changed on December 18, fifteen days after the operation, and the parts were found to be covered with a thin layer of healthy granulation tissue. Tenderness to pressure over the jugular had entirely disappeared. The dressing was again changed on the 24th, when granulations were found to be growing vigorously, and thereafter the dressing was changed when necessary, some half-dozen times in all.

Patient made an uninterrupted recovery despite an attack of chicken-pox during his convalescence, and is now (April, 1904) strong and active, the only sign of the operation being a very slight scar behind, and hidden by, the pinna of the ear.

ON THE USE OF AN ELECTRO-MAGNET FOR REMOVAL OF A FOREIGN BODY FROM A BRONCHUS.

BY ANDREW J. HOSMER, M.D.,

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On March 31, 1904, a female child sixteen months old, while lying on its back on the nurse's lap playing with a shingle-nail, was observed to suddenly strangle and cough severely, and the nail had disappeared. The mother was away from home, and did not return for about half an hour. The child coughed considerably, but before the mother's return had eaten a good meal of bread and milk, and was in good condition except an occasional cough and a wheezing respiration. Dr. E. G. Gowen was at once called. Dry food only was given for three days, and during the week the child was treated for bronchitis. The symptoms remained about the same for the week, except the coughing was more frequent and severe.

The child was brought to me April 7. On putting my ear over the sternum, a whistling respiratory sound was heard, and by means of the fluoroscope a shadow that might be caused by a nail was indistinctly outlined in the chest. The child was then anæsthetized by Dr. E. W. Whitney, and the accompanying radiograph taken. (Fig. 1.) It shows the head of the nail reaching down to the upper border of the seventh rib on the left side, the point reaching upward diagonally to the lower border of the fourth rib on the right side, hence the nail had entered the left bronchus head downward, and was lying behind the base of the heart

All the authorities consulted considered the removal of a foreign body from this location a very difficult problem, and gave a very high mortality.

Among other means for its removal, I thought of a magnet, and made inquiries of several so-called electricians to see if the idea were tenable, not knowing that any one else had attempted the magnet for this purpose. Recently I have noticed in the Annals of Surgery, December, 1902, that Dr. Brokaw, of St. Louis, had made an unsuccessful attempt to remove a tack by means of the

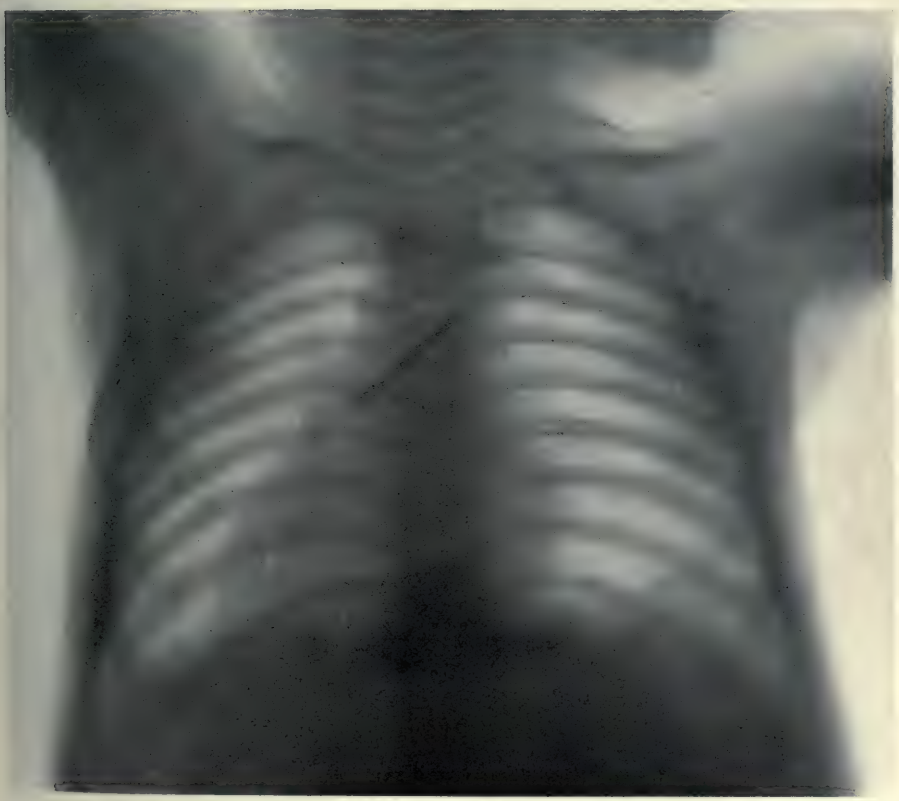


FIG. 1.—Shingle-nail lodged in bronchus.

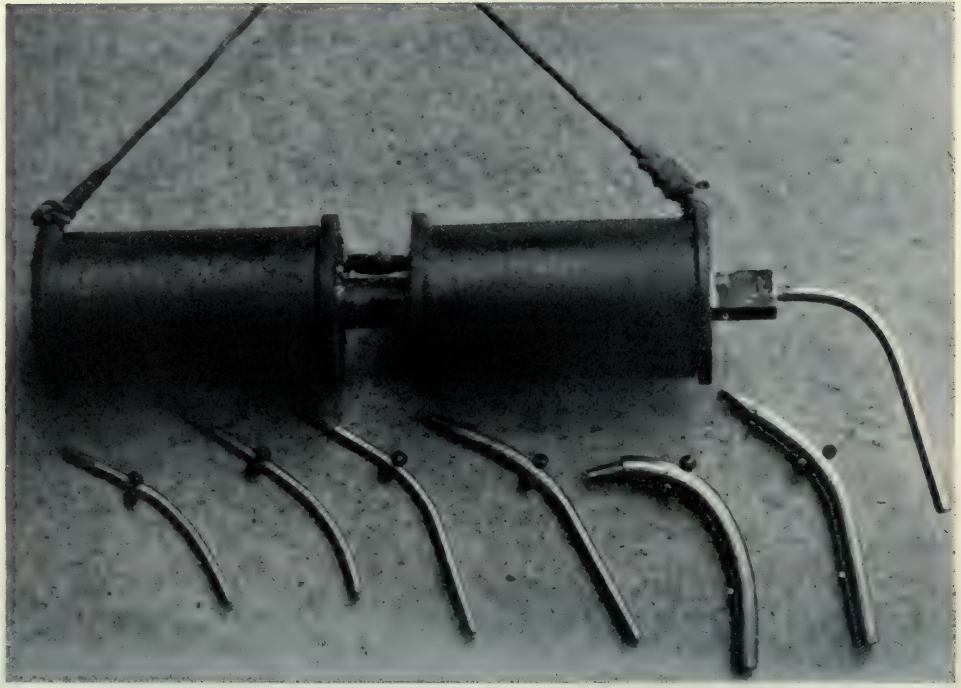


FIG. 2.—The Pfoutz-Godbe Magnet.

magnet from the bronchus of a child eight years old. But first to assure my skill in the mechanical method, I secured a dog, made a tracheotomy, put a shingle-nail head first into the bronchus, and attempted its removal by means of various ingenious instruments. I was unsuccessful; the dog died. I decided some other method must be used, and began to consider further the magnet. Dr. G. B. Pfoutz was consulted, to whom Dr. H. C. Deane presented a small electro-magnet secured from Dr. Baldwin, which Dr. Pfoutz took to Mr. Murray Godbe, an electric engineer with the Utah Light and Power Company, with whose collaboration was produced the electro-magnet shown in the accompanying picture. (Fig. 2.)

By means of this magnet, we were able to attract a shingle-nail for about two inches through space, and it required considerable force to detach it when once contact had occurred.

Accordingly, believing that this magnet would pull the nail from its bed in this little bronchial tube, on April 13, thirteen days after its lodging there, with Dr. Pfoutz's assistance, I made a low tracheotomy, and introduced the projecting tip of the magnet along the trachea down near to the point of the nail, and instantly, on the current being turned on, a distinct click, heard by all present, indicated that contact had occurred, and I gradually and carefully removed the magnet with the nail dangling on its point. I believe this to have been the first successful removal of a foreign body from a bronchial tube by means of a magnet. The wound was partially closed, and the child made an uninterrupted recovery.

We should be able to remove magnetic substances from the stomach and bladder by means of the electro-magnet, and it appears to me possible that in some cases, when the substance is in the trachea, or bronchi, a tracheotomy will not be necessary. The following description of the electro-magnet used in this case has been furnished by Mr. Godbe.

The magnet consisted of a Norway iron core, five-eighths of an inch in diameter and eleven inches long, on which was wound, in two sections, 6400 feet of No. 24 double cotton-covered magnet wire, making 9000 convolutions around the core, and having 160 ohms resistance.

It was designed for operation on 250 volt direct current, that

being the service available in your operating room. With that voltage there was passed one and one-half amperes of current, or 13,500 ampere turns around the magnet core. The end of the core was drilled and tapped to receive the Norway iron stems, a number of which were made in different sizes and shapes in order that you might select the one suitable for your operation. The one you selected and used in your operation was constructed of one-fourth inch Norway iron, and is the one attached to the magnet, and bent in the shape as shown in the photograph herewith. (Fig. 2.)

The number of magnetic lines that can be forced through a given cross-section of iron depends not only upon its quality or permeability, but upon its saturation. For instance, if a small number of lines are flowing through the iron at a given excitation, doubling the excitation will double the lines of force; when the lines reach a certain number, increasing the excitation does not proportionately increase the lines of force, and an excitation may be reached after which little, if any, increase of lines occurs with increased excitation.

Iron or steel used in magnetic circuits must be tested by sample before an accurate calculation can be made; and as the iron used in this magnet was no doubt thoroughly saturated, and also considering the magnetic leakage from the stem, accurate results as to the "pull" or "traction" of the magnet at its point could only be determined by actual measurement, which I find to be as follows: a lifting power at its point of 100 grammes, and a pull of ten grammes on the substance one-fourth inch from its point.

The use of this magnet in your operation has suggested to me the use of properly constructed electro-magnets in any case requiring the removal of magnetic substances from the body, and although my suggestion is along the line of the earliest discoveries, it might not be considered by those hurriedly called upon to construct a magnet for emergency use, as in your case, or those designing such a magnet in the shops.

We must conceive of a magnet in any shape having a definite circuit, that is, the lines of force passing from its north pole and entering its south pole. For many purposes this conception of poles is a very serviceable one; it is especially so when we have to treat of the influence which a magnet exerts throughout the space in its neighborhood, or throughout what is called the *magnetic field*. In this magnetic field the two poles will exert two forces,—one

tending to pull the particle towards it, and the other to push the particle from it. These two forces will have for their resultant a single force, which is the whole force exerted by the magnet on the particle, and will depend upon the amount of magnetic substance in the particle, and the number of magnetic lines embraced by the substance.

It will be seen, therefore, that any magnetic substance, to be attracted to the pole of the magnet, should be as near as possible in that portion of the magnetic field having the greatest magnetic density.

It has occurred to me that a large and powerful electro-magnet could be constructed and mounted so as to be easily placed in any position relative to the body being operated upon, and having different sizes and lengths of flexible iron stems, attachable to the magnet core, for insertion into wounds or parts of the body for the removal of foreign magnetic substances. If this magnet is so placed that the point of its stem and the substance to be removed will be in the field of greatest density, I believe satisfactory results can be obtained.

REMOVAL BY GASTROTOMY OF A HATPIN SWALLOWED BY A TWENTY MONTHS' OLD CHILD.

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THE following case was referred to the Röntgen-Ray Laboratory, Cornell University Medical College, by Dr. G. M. Ball, of New York City:

A female child, aged twenty months, on April 11, 1904, was playing on a bed with her mother's hat, in which there were three hatpins; the child was noticed to fall forward in her play. After awhile the mother lifted her from the bed and noticed that the child coughed a little; immediately thinking of the possibility of the little girl having swallowed something, the mother glanced about the bed, but felt reassured, as there had been seemingly nothing which the child could swallow. From that time on the patient held her body stiff when she stooped to pick up anything from the floor, also complained of pain whenever the body was bent. The third hatpin was missing, and on searching about the house could not be found. For three days following, the child's temperature ranged between 100°–101° F., accompanied by symptoms of bronchopneumonia. Examination of the throat revealed a few slight inflammatory areas, but no evidences of a foreign body.

On April 20, the right arm was noticed to be colder than the left, and this persisted until after operation; on April 21 the child passed a thin film of blood-clot in a stool. Two days later a skiagraph was made, the child's trunk being bare to avoid misleading images of pins in the child's clothing.

As can be seen in the accompanying radiograph (Fig. 1), the diagnosis was positive; it was evident that the child had managed to swallow one of the hatpins. The head of the pin

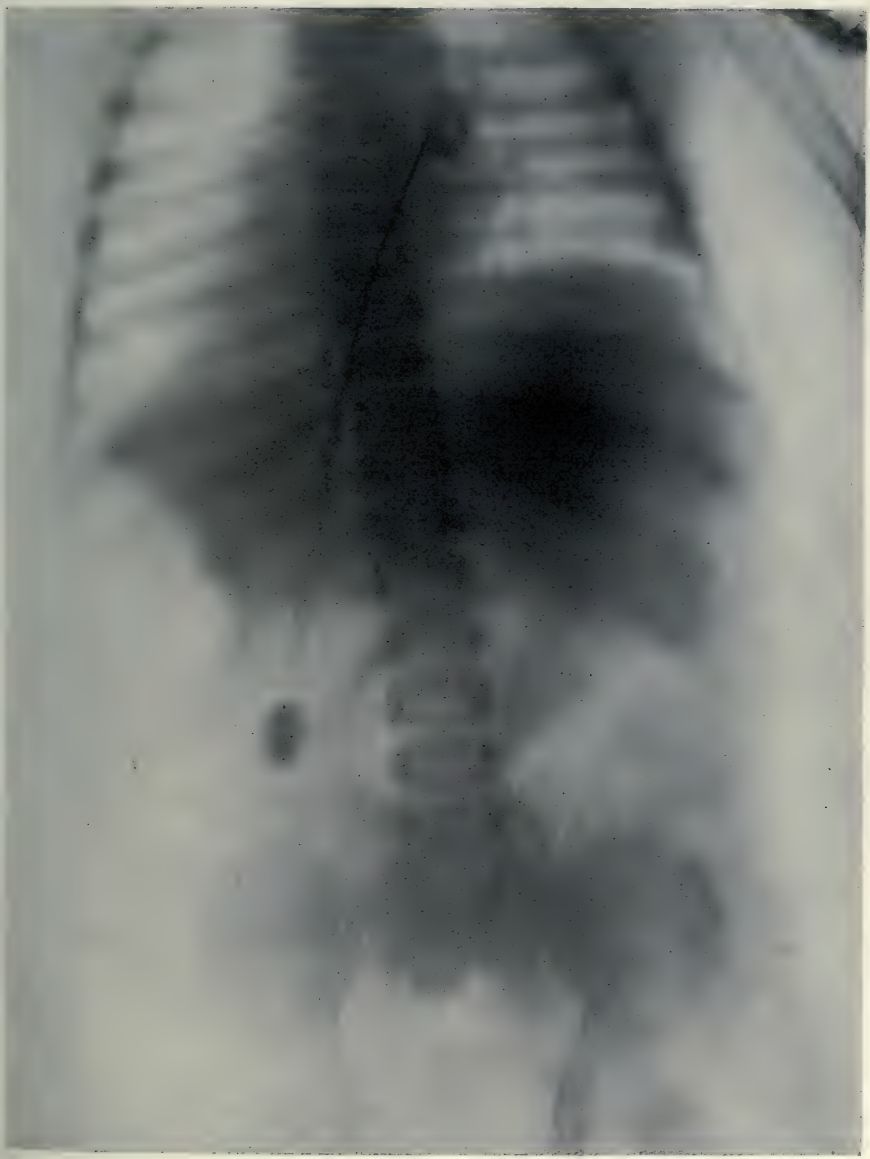


FIG. 1.—Location of hatpin.

being downward to the left of the spinal column opposite the intervertebral cartilage between the second and third lumbar vertebræ, and the point upward, to the right of the spinal column on a level with the second dorsal vertebra. Around the point is a shadow with a dense periphery probably due to a small hæmorrhage with beginning coagulation. (Similar shadows have been visible in other radiographs where the blood could be demonstrated. The shadow is not dense enough, nor of the right shape, to be that of some foreign body, as a button.)

On April 26 the case was referred to Dr. F. W. Gwyer, under whose service she was admitted to Bellevue Hospital. During all this time (fifteen days) the child presented no other symptoms than those mentioned; there was no vomiting, the appetite was good, bowels regular, and she slept well. On admission to the hospital, the temperature was 98.6° F.; pulse, 108; respiration, 24.

Gastrotomy was done within a few hours after the admission of the patient. Under ether, the head of the pin could be readily palpated through the abdominal wall about midway between the ribs and the pelvis, on the left side, under the outer half of the rectus muscle. A vertical incision was made through the rectus, but lower than the ordinary incision, with the idea of facilitating the withdrawal of the pin without bending it and so causing damage with the point. The stomach was opened and the head of the pin found pressed against the posterior wall of the stomach. It was necessary to pack a little gauze about it on each side so as to raise it sufficiently to catch it with the forceps; it was then drawn out with ease. The wounds in the stomach and abdominal wall were closed. The child made an uncomplicated recovery, being discharged from the hospital, May 8, 1904.

The most feasible explanation of how the child swallowed such a long pin is that she was playing with the head in her mouth, and on falling forward the point struck on the soft bed and the pin was driven head foremost down the œsophagus. The smooth, round head gliding down without injury, much as when an œsophageal bougie is inserted, the pin being too small in diameter to be grasped by spasm or contraction of the œsophageal muscles.

The case, I think, is exceptional in that the length of the

object is great, especially relative to the size of the child; there were so few symptoms and so little inconvenience during the pin's fifteen days' residence in the child, and in that so little damage seems to have been done to the œsophagus, pleura, and lung, some of which it probably punctured.

I wish to thank Dr. G. M. Ball, Dr. F. W. Gwyer, and Dr. R. M. Vose (Resident Surgeon, Bellevue Hospital) for the opportunity of observing and reporting this case, and also for their clinical observations and co-operation.

DETAILS OF THE TECHNIQUE OF A POSTERIOR GASTRO-ENTEROSTOMY.

BY CHARLES L. SCUDDER, M.D.,

OF BOSTON, MASS.,

Surgeon to the Massachusetts General Hospital.

THE preliminary preparation of the patient, the isolation of the operative field, the selection of the places in the stomach and the intestine for the anastomosis, the use of rubber-covered clamps, the rapidity of suture without the use of needle-holder, the employment of relatively large needles, the continuous suture, the use of the Pagenstecher linen thread, the very careful attention to every step, absolute cleanliness, absolute hæmostasis: these are the details which mark a new era in the development of the technique of gastro-enterostomy. The operation is consequently attended, to-day, with little if any risk to the individual patient.

Wölfler's method of performing an anterior gastro-enterostomy is of service in certain selected cases, particularly those of malignant disease and of ulcer of the stomach in which the posterior operation is not feasible because of adhesions or infiltration of the stomach wall. It is coming to be recognized by those who are doing stomach surgery, both upon the Continent, in England, and in America, that the nearer to the origin of the jejunum the anastomosis with the stomach is made, the more satisfactory is the convalescence and subsequent course of any individual case. In only one clinic which I visited the past winter (that of Krause) did I find the anterior operation still being used as a routine procedure. In the clinics of Kocher, Czerny, Mikulicz, Von Eiselsberg, Körte, Kümmell, Witzel, Hartmann, Robson, and Moynihan the posterior operation is the operation of choice, each of these surgeons, of course, varying the details in some particulars.

Kocher's method of doing a gastroduodenostomy is advantageous because the exit from the stomach is made proximal to the bile and pancreatic supply. It is a physiological opening that is secured.

Finney's gastropyloduodenostomy is similarly physiological. In my opinion, each of these latter procedures is theoretically, and I surmise practically, preferable to the posterior gastrojejunostomy. Whether the anatomical and physiological results are better after division of the pyloric sphincter or following the gastroduodenostomy of Kocher is yet to be determined. The mobilization of the duodenum after Kocher's suggestion is ordinarily possible.

The patient's mouth and teeth, several days previous to the gastro-enterostomy should be thoroughly cleansed by brush and swab and alkaline wash. For three or four days before operation, the patient should be placed upon a restricted diet. This diet should consist chiefly of liquids and soft solids which do not leave much residue. Twenty-four hours before operation, the diet should be restricted to liquids which have been sterilized—either sterile milk or sterile bouillon. The intestine should be empty, so as to secure to the operator, after the abdomen has been opened, as much room as is possible. Gentle gastric lavage should be made, when not contraindicated, each of three mornings previous to the operation, and again the day of the operation. An empty sterile stomach is a desideratum. Preparation of the skin of the abdomen in the region of the operation should be very thorough. The umbilicus should be especially cleansed. There should be no antiseptic used on the skin the morning of the operation. The skin should be washed with sterile salt solution or with boiled water just previous to operating.

The technique of a posterior gastrojejunostomy, as I am doing it to-day, without a loop is as follows: An ample incision is made through the middle of the belly of the right rectus abdominis muscle. All bleeding points are ligated before incising the peritoneum. A long incision is more desirable than a short one. The technical details of the operation proper are facilitated by an easy exposure of the parts. More thorough inspection is possible through the long incision. Upon opening the abdomen the duodenum and the whole of the stomach should be examined carefully, in order to detect possible lesions. The gall-bladder, the transverse

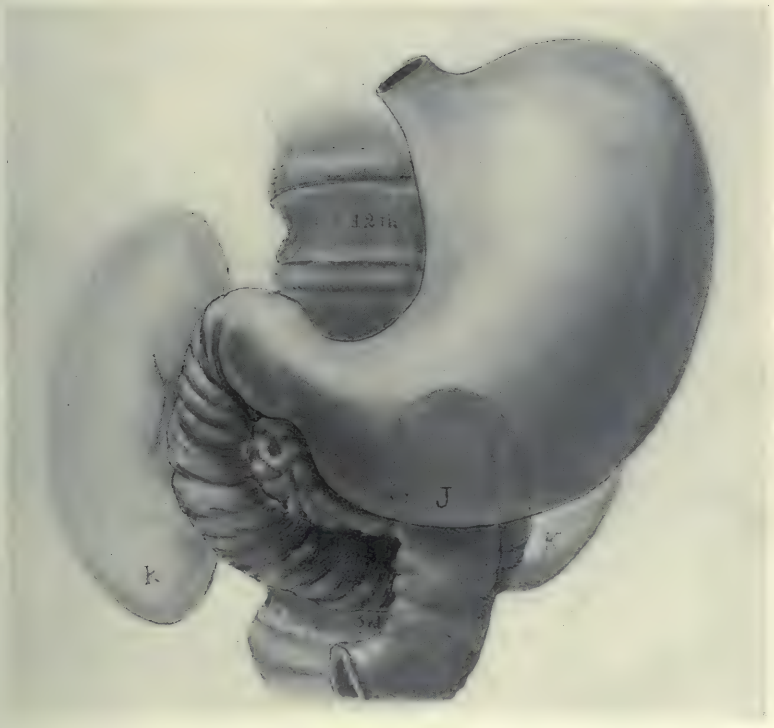


FIG. 1.—To show the relation of the beginning of the jejunum to the posterior wall of the stomach under normal conditions.

Note the tortuous course of the duodenum. Note that the natural place for the anastomosis between stomach and jejunum is where the jejunum rest against the posterior gastric wall.



FIG. 2.—To show the beginning of the jejunum and the peritoneal fold above the superior mesenteric vessel. To show the method of grasping with the left hand the transverse colon and the pushing the posterior stomach wall through the small rent made in the transverse mesocolon. The colic vessels supplying the colon are shown, as well as the vessels of the greater curvature of the stomach.

The omentum is purposely omitted from the drawing.

A line connecting the two points x and y indicates the best angle at which to apply the clamp to the stomach.

colon, particularly the hepatic and splenic flexures, the pancreas, and the appendix should be especially palpated and their conditions determined and recorded.

The great omentum and transverse colon are lifted completely out of the abdomen at the upper angle of the wound, placed upon a sterile towel covering the sterile abdominal skin, thus exposing the under surface of the transverse mesocolon. While the left hand grasps the transverse colon and omentum, the fingers of the left hand push the posterior wall of the stomach, in its pyloric portion, firmly against the mesocolon. The right hand incises with a knife the transverse mesocolon, thus exposing the posterior wall of the stomach. (Fig. 2.)

This incision is so placed that large vessels are avoided. Its direction is at right angles to the transverse colon's long axis. The incision is enlarged by gentle tearing of the mesocolon. The pressure of the left hand forcing the stomach through the mesocolon assists in the enlarging of the opening in the mesocolon to the required size. The opening in the transverse mesocolon should be some four or five inches long. If by chance there are any bleeding vessels at the edges of the mesocolon opening, these should be ligated. The large colic vessel, which nourishes the transverse mesocolon (Fig. 2), should of course be carefully avoided.

The posterior wall of the stomach is picked up by two pairs of dissecting toothed forceps, thus freeing it from the anterior wall of the stomach which is being pressed against it, and the stomach clamp, as suggested by Littlewood (London *Lancet*, November 3, 1900, page 1276), is applied. The clamp should be placed so as to avoid including, as far as possible, many large vessels. It must be remembered, however, that the large vessels mark the lowest border of the greater curvature of the stomach. This clamp is applied so as to compress the walls of the stomach sufficiently to prevent bleeding and exit of stomach contents. The clamp is placed a little obliquely upon the stomach, in the line joining "x" and "y." (Fig. 2.)

This oblique position is advantageous, according to Moy-

nihan, for upon replacing the stomach and jejunum in the abdominal cavity after the anastomosis is completed, the incision in the stomach lies most naturally against the jejunal incision without undue traction. (See Fig. 1, illustrating anatomical relations of the parts under consideration.) The beginning of the jejunum is next sought a little to the left of the spinal column and at the attachment of the transverse mesocolon. The jejunum is picked up by two pairs of toothed forceps, placed opposite the mesenteric attachment, at that distance from the peritoneal fold, marking the beginning of the jejunum, which is suitable to the case in hand. The nearer to the beginning of the jejunum the anastomosis can be made the more satisfactory will be the result. The clamp is placed longitudinally upon the jejunum opposite to the mesenteric border. The anastomosis is made so that the peristaltic movement of the jejunum occurs in the same direction as the peristaltic movement of the stomach. The clamps upon the stomach and upon the jejunum are placed alongside of each other, thus bringing the parts of the stomach and jejunum to be anastomosed into close apposition, entirely outside the abdominal cavity (Fig. 3).

The omentum and transverse colon are now, if possible, replaced within the abdomen. Two layers of gauze sponge or two layers of towels are placed beneath the clamps so as to protect the underlying tissues. A gauze sponge is placed between the two clamps, thus protecting the area to be anastomosed immediately behind the gut and stomach. (Fig. 3.) It is wise to have the sterile towels wet with hot normal salt solution.

The first, or peritoneal, suture is now taken with curved needle and No. 3 Pagenstecher linen thread. The suture is started at a point farthest from the surgeon and is made towards the surgeon. The suture includes peritoneum and muscular coats. The Cushing suture is used. The initial end of the suture is left long. The curved needle * is of such a size

* I am using a needle made for me as a modification of Moynihan's needle. It is long, and so curved that it may be grasped by finger and thumb firmly without needle-holder, and it picks up just enough tissue to be efficient.

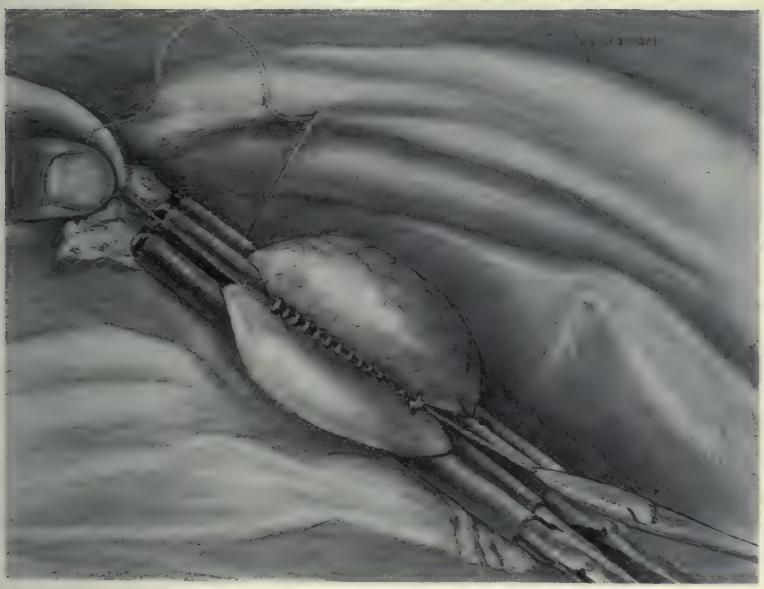


FIG. 3.—To show the clamps applied to the stomach above and to the jejunum below. Note the angle at which clamps are applied. Note the strip of gauze between clamps posteriorly. Note the first half of the peritoneal suture being taken. Note that the suture is not drawn as tightly as usual in order that it may be seen in the drawing.

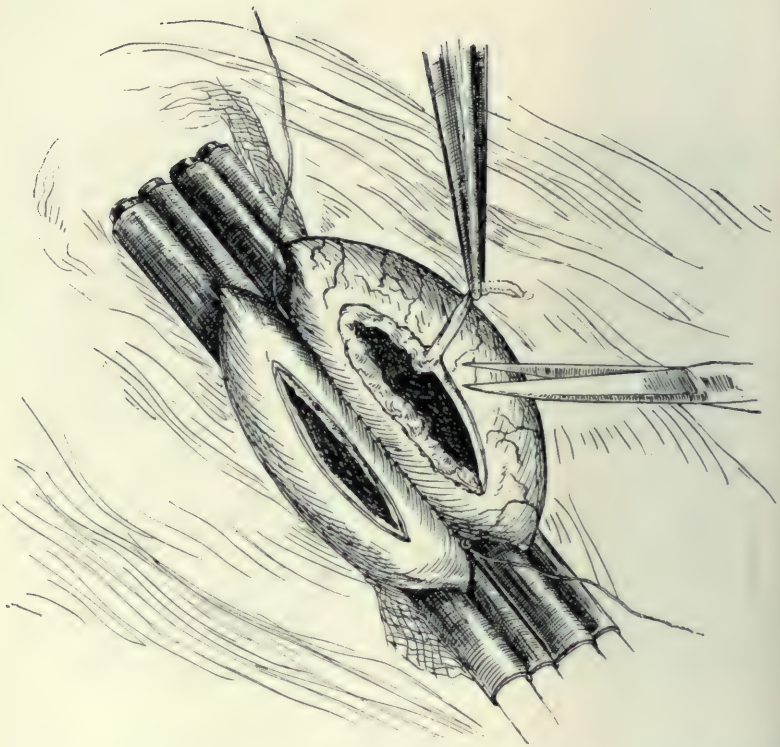


FIG. 4.—To show the removal by scissors of the prolapsed mucous membrane of the stomach, after the incisions into the stomach and intestine. Note that the mucous membrane from the jejunal opening has been already removed. Note that enough is removed to make the peritoneum and mucous membrane level. The first half of the peritoneal suture is shown completed. The gut is seen grasped by the clamps at the mid-portions of the blades of the clamps to secure evenness of pressure.

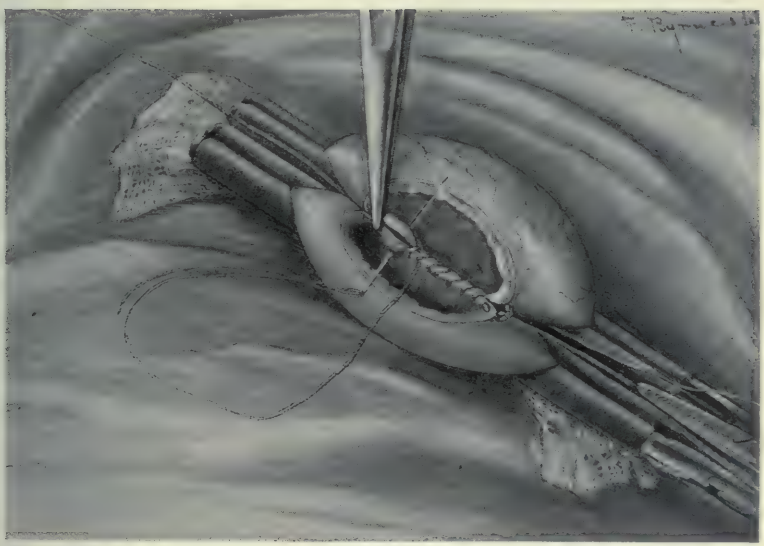


FIG. 5.—To show the taking of the first half of the through-and-through or hæmostatic suture.

Note at the beginning that a seroserous suture is taken and tied, that then the needle passes into the gut and then through and through all layers of both intestine and stomach walls. It is an over-and-over, through-and-through continuous suture.

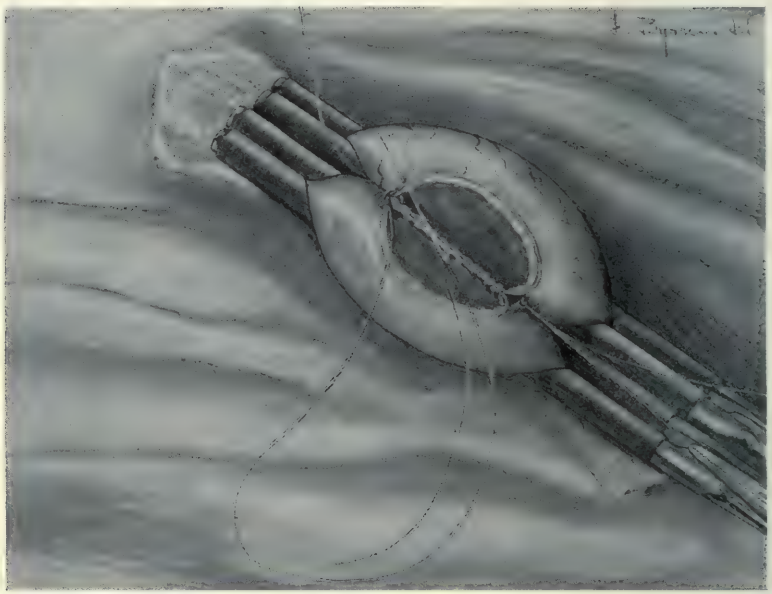


FIG. 6.—To show the second half of the second or through-and-through suture.

The needle passes always from mucous membrane to peritoneum on one side to peritoneum and mucous membrane upon the other side, and then the peritoneal surfaces are always brought into apposition. Note the needle is beginning the return suture.

that it may with ease be used without a needle-holder. Speed is thus gained in suturing. Having completed the first half of the peritoneal suture, the thread is left long, the needle and thread being covered by a wet gauze sponge. This insures complete protection to the suture from infection.

The stomach and jejunum are next opened by a knife incision, parallel with the line of suture just completed. The incision in the jejunum is therefore a longitudinal one. [The transverse incision of Mikulicz and Kocher limits the size of the opening.] The incisions are placed about one-half inch from the line of peritoneal suture. The stomach and jejunum having been opened by the knife, the opening is completed by the use of scissors. The size of the opening made will depend upon the physical conditions present. An opening of from two and one-half to three inches is ordinarily needed. Intestinal contents and stomach contents are carefully removed by tiny gauze sponges at hand for this purpose. By the use of a large sponge the peritoneum is more liable to be soiled. Usually, only a few drops of stomach or intestinal contents present after the incision is made, and are readily removed. Soiling of the peritoneum is precluded. The prolapsed mucous membrane of both the stomach and the jejunum is excised, as suggested by Littlewood (London *Lancet*, November 3, 1900, page 1276), by means of scissors, so that the mucous membrane is level with the peritoneum. (Fig. 4.) This is done to facilitate subsequent suture and to preclude the possibility of slight valve-like obstruction to the lumen of the anastomotic opening. The mucous membrane thus removed should be preserved in a sterile receptacle (a culture tube or sterile gauze), and should be examined microscopically.

The first half of the second suture is now taken with a straight No. 6 milliner's needle and No. 3 Pagenstecher thread. These large, straight needles are most useful. This suture is begun by taking a peritoneal and muscular stitch through both stomach and intestine. (Fig. 5.) The needle is then carried into the lumen of the bowel and through and through all coats of both jejunum and stomach, in an over-and-over continuous suture. Great care must be exercised that the

through-and-through suture includes always the mucous membrane of both stomach and jejunum. If this is done, hæmorrhage is almost impossible. Upon reaching the end of this suture, the needle is carried out from the lumen of the bowel through the peritoneum and tied to the initial peritoneal stitch. Thus peritoneal surfaces are brought into close contact throughout this whole suture. This through-and-through suture serves not only to secure peritoneal approximation over quite a broad surface, but serves as an hæmostatic suture. This continuous through-and-through suture may be interrupted once or twice, as suggested by Littlewood.

Both clamps are now loosened. One of the clamps is removed. The other is left in place, but open, that it may serve as a shelf upon which the bowel and stomach may rest and not slump into the abdominal cavity, as suggested by Munro. (Fig. 8.) Upon loosening the clamps, if there are any bleeding points noticeable, these are secured immediately by a curved intestinal suture. Ordinarily no ligature is required. The lumen of the gut and stomach now being closed, and all possibility of soiling the peritoneal surfaces being eliminated, the whole region should be wiped with sponges wet with hot salt solution, the towel uppermost should be removed, thus leaving the clean second towel exposed. The gauze sponge which lies between the clamps and is behind the suture line is used to make traction upon the anastomosed part and assists in exposing the posterior suture line to inspection. [Moynihan.] Having inspected this part and determined that there is no bleeding, and wiped it thoroughly, this posterior bit of gauze is withdrawn.

The second part of the peritoneal stitch is now completed. The whole field of operation being absolutely clean, the edges of the opening in the mesocolon are sutured to the posterior wall of the stomach in two or three places, by single interrupted Pagenstecher sutures. This prevents contraction of the opening and consequent subsequent constriction of the gut. This suture also prevents a hernia of the small intestine into the lesser cavity of the omentum. There is also less likely, because of this suture, to be a kinking of the gut. The distal

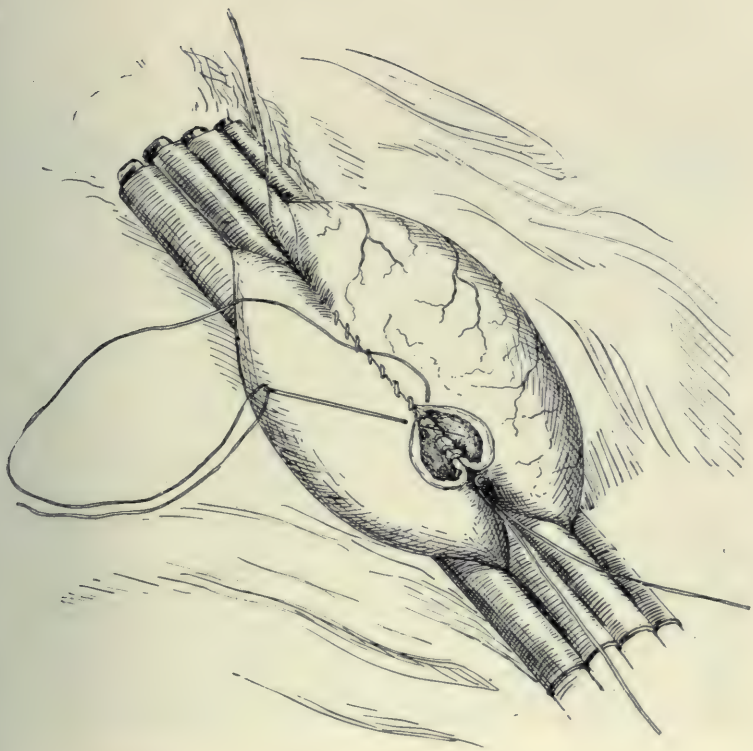


FIG. 7.—To show the completion of the second half of the through-and-through suture. Note how the opening has been gradually closing. Note the needle finishing the stitch. Note, that to finish suture ideally the needle passes through peritoneum last, and is then tied to the first peritoneal suture used at the starting place. See figure. Thus peritoneal surfaces are brought into contact.

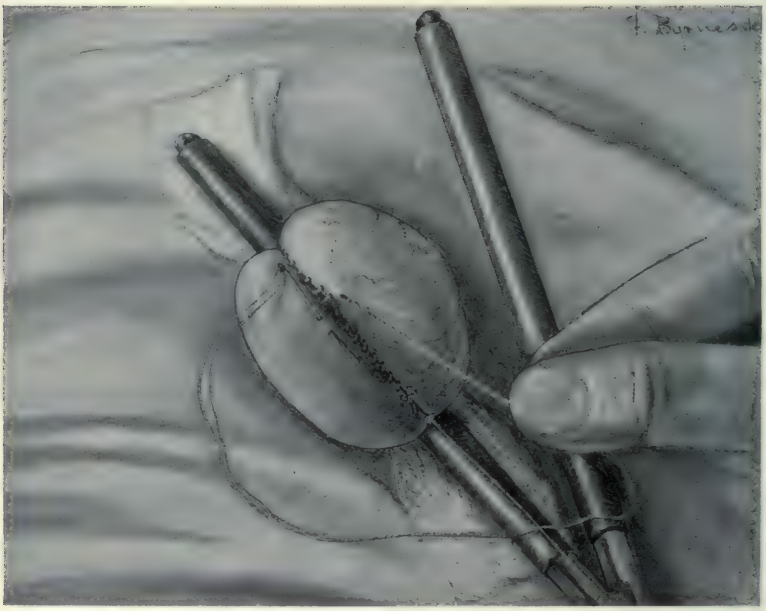


FIG. 8.—To show the second or through-and-through suture completed. To show the second half of the first or peritoneal Cushing suture. Note that the clamp upon the jejunum has been removed. Note that the clamp upon the stomach has been loosened, but that one blade has been retained to serve as a shelf to hold the part well without the abdomen, and thus to prevent slumping of the part until the suture is completed and the parts are cleansed finally.



FIG. 9.—To show diagrammatically the location of the opening secured by this operation between the stomach above and anteriorly and the jejunum below and posteriorly. S indicates the stomach cavity. I indicates the intestinal lumen.

portion of the jejunum is now replaced in its natural position, whatever this may be in the individual instance, usually it is to the right of the spine. The omentum is replaced, covering all. The abdominal wound is closed. The patient, on the second day, sits in a semirecumbent posture to facilitate the passage of stomach contents into the intestine.

Treatment subsequent to operation. Nutrient enemata, small in amount, every eight hours may be used for forty-eight hours. Nothing is given by mouth for twenty-four hours, then liquids are given in small quantities at frequent intervals. The amount of nourishment taken by mouth in the third twenty-four hours is gradually increased, until at the end of a week soft solids and minced beef and chicken are allowed.

Of all gastrojejunostomy operations, the technique as described in this communication seems to me to be the most speedy and simple of performance. Risk from infection is completely eliminated. The occurrence of any obstruction (a vicious circle) is most unusual following this technique. Personally, I have had no cases of vicious circle.

Three questions are yet unsolved in connection with the operation of gastro-enterostomy. (*a*) The permanency of the artificial opening when the pylorus is patent; (*b*) the desirability of permanency; and (*c*) the likelihood of an ulcer forming in the jejunum. Roux's method has been followed in a few instances by a peptic ulcer in the distal loop. Roux explains this very reasonably by saying that in the peptic ulcer cases the proximal loop has been anastomosed too far from the stomach opening. He has personally had no such ulcers form because he has joined the proximal loop to the distal loop near to the stomach. The bile and pancreatic juice thus are enabled to neutralize any deleterious effect of the acid gastric juice. I believe that if the anastomosis with the jejunum is made close to its origin, as indicated in the above technique, the slight danger from peptic ulcer will be eliminated. Kocher's gastroduodenostomy and Finney's gastropyloduodenostomy, with slight modifications in the technique as described by Finney, appeal to me physiologically, when anatomically possible of execution, as ideal operations.

GANGRENE OF THE HOLLOW VISCERA.[1]

A REPORT OF THREE CASES, WITH ILLUSTRATION.

BY VERTNER KENERSON, M.D.,

OF BUFFALO, NEW YORK,

Attending Surgeon to the Erie County Hospital, the Emergency Hospital, and Instructor in Clinical Surgery in the University of Buffalo.

On March 26, 1902, I was called by Dr. Hugh McIntire, of this city, to see with him and with his colleague, Dr. John C. Thompson, also of this city, Mr. E. M., a collector at one of the local stations of the frontier.

This man had been a politician for a number of years and was justly popular among his friends. He had been a heavy drinker, or one would say he had been a steady drinker of perhaps five or six drinks of whiskey per day. He was a robust man, weighing about 175 pounds, and had always enjoyed apparently good health. He had been for years troubled with constipation, and had tried various remedies for the cure of the same.

Prior to my consultation with Dr. McIntire and with Dr. Thompson, the man had after some little dissipation and an extra fit of constipation remained at home for several days, suffering from slight nausea, vomiting, and diarrhœa, but had been about the house. He had, however, the day previous to my visit, decided that he was well enough so he could return to his work at the office, and so announced to the attending physician, and he had gone to the office.

He had, however, to return home because of the distress in his abdomen; shortly after his arrival home, he was taken with very severe pains, and, although he suffered intensely and was advised that he needed surgical interference, he refused to have me called until twenty-four hours later, and then he was not suffering so much pain, but he had been given liberal doses of opiates. On March 28, 1902, I found him with a temperature of 99.5° F., with a pulse of 140, and respirations were 20. He had evidently been in

[1] Read before the Medical Union of Buffalo, New York.

great distress. His face was covered with beady perspiration, and he was blanched somewhat, but was not dull or apathetic.

His abdomen was immensely swollen and he was tympanitic. A few hours before I saw him he was very sensitive all over the abdomen to any manipulation or examination, but complained of a very severe and constant pain in the epigastrium. No localized pain in the region of the appendix. When I examined him, he would allow, either on account of the opiates that he had had, or on account of bowel paralysis, a palpation, and that without evidence of pain that was intense.

The general symptoms were so marked that at the time I was not at all sure that the trouble was not appendicitis, even though the previous history was indefinite and the immediate history gave the epigastrium as the seat of the greatest pain, and that the general peritoneum had when I saw him become involved, and that he was beyond hope of operative interference. After consulting with the doctors, although he had refused, for the twenty-four hours previous, to have any operative interference, when assured by me that his chance of recovery was commensurate with the speed with which surgical interference was undertaken, and that his condition without operation was entirely hopeless, he agreed, and was sent to Riverside Hospital, where I operated as soon as he could be prepared.

A six-inch incision was made in the epigastrium, because that was the point where the pain had been most pronounced. As soon as the opening was made into the peritoneum there flowed out a large amount of serous bloody fluid. This fluid was purulent, was not yellow, but was as described, serous and somewhat streaked with blood.

Examination showed that the greater part of the small intestine was normal in appearance and feeling; that the colon was not involved, was not distended; that there were not adhesions of one coil of intestine to another, was no localized point of inflammation, and no abscess cavity "walled off."

A part of the small intestine was found to be very much inflamed, and for a space of about twenty-six inches was almost in a necrotic condition. Eighteen inches of the gut, which was practically black, were resected.

This small intestine was of darker color than is usually encountered in cases of strangulated hernia. It was necrotic, but did

not have the same black color as would be found in dry gangrene involving the external skin, where the necrotic area shows jet black. This was a condition of moist gangrene.

The omentum which was pushed up showed no pathological indications. It was not adherent. The mesentery, however, was swollen, hard, filled with nodules varying in size from a pea to that of a pigeon's egg. The mesentery supplying the whole area of necrotic intestines was involved. It is usually easy to turn the coils of the intestines from side to side, that is, in normal peritoneal cavities the mesenteric attachment forms no obstacle to the manipulation necessary to make a full and complete exploration. Not so in this case. Any attempt to move the coils involved was met with such resistance from the mesenteric attachment that it seemed almost brittle, and one was constrained to use care lest disruption of the bowel should occur.

The caliber of the bowel in general was increased, but the thickness of the bowel wall was several times over-increased. The lumen was empty, save for the serous fluid which surrounded the part involved, and which evidently came from the bowel and the mesentery. With great care the incision was retracted, the gut lifted, examined, the limitations determined, and the resection performed, removing about eighteen inches of the blackest gut. A medium-sized Murphy button was placed in position and the large amount of omental surface that was cut through as the necrotic gut was severed was tied off with medium-sized catgut, and then sewed "over and over" with fine catgut.

The place where the Murphy button was inserted was reinforced with twelve fine Lembert sutures of fine silk, and the whole was closed up. The external wound was closed with silkworm gut, but several drains of iodoform gauze were left *in situ*.

The small intestine that was not involved by this necrotic area looked perfectly normal, was reddened but little, even though the whole abdomen was filled with the serous fluid, and although the intestines were all distended by flatus. The necrotic areas were dark, cyanotic, reddened, and in the worst part were blackened, and the circulation was evidently entirely shut off.

The mesentery was much swollen, very hard, and seemed to be filled with nodes. Usually, the mesentery is soft, very pliable, and can be pulled about to examine the intestines and to see the different sections of the gut that are under discussion. In this

instance the swelling was so great in the mesentery that the gut could not be moved without rupturing the peritoneal covering of the mesentery.

The mesentery was swollen in nodular masses, and the whole looked or rather felt like the nodes that appear in a rapidly growing cancer, say of the breast, but of course was all injected with the reddening of the general peritonitis. When the hæmostatics were thrust through this swollen and much injected mass of mesentery, as was done in the tying off of the mesentery preparatory to the removal of the necrotic gut, there was little bleeding, but a considerable oozing of a kind of serum from the ruptured peritoneal coating and from the places where it was cut through.

The general appearance was as if there was cancer of the mesentery and following necrotic area of the gut. Examination of the nodes, however, with the microscope did not show any cancerous growth, but the appearance was of a very much inflamed and overswollen area of mesentery. The patient died six hours after the operation.

This man had no specific history; he had been married and had three beautiful and healthy children. He had never had any skin trouble of any kind that might be mistaken for specific trouble. His wife and children are still living in the city, and are all well and healthy. His arteries were hardened to some extent, and he had a resistant impulse at the radial, but the artery could be compressed so that the current could be stopped. He had been a steady drinking man for years, and yet was never intoxicated. The appendix was examined, and there was nothing to lead any one to believe that there had been any origin of the trouble at that point.

The second case was a patient of Dr. C. M. Brown, of this city, who asked me to see him in consultation with him, giving me the following history:

J. P., forty-five years old, and a cooper by trade; weight, 140 pounds when at work and in fair health. Previous history.—Discovered that he had syphilis about one year ago, and has not had regular treatment since that time, but has taken enough, so that there was no eruption evident on the skin at this time. He had some inflammatory condition of the bladder about six years ago..

The patient was taken sick about one month ago, and has had nausea since that time, gradually getting into such condition that he had not retained anything on his stomach for more than a few minutes for four days. Has had twenty-seven stools in the twenty-four hours previous. He was in great distress, although he had been well supplied with opiates during that time. His temperature was 98° F.; pulse, 72; respiration, 18. The pulse was soft, weak, but regular. The vomitus was the water and fluid recently taken and streaked with mucus and blood. The stools were remnants of liquids taken by bowel for nourishment, yellowish and foul smelling. No solid particles, no blood in stools I saw, but there had been some traces.

His face had the typical abdominal distressed appearance. He had emaciated a great deal in the period of his sickness, and had tried, and very intelligently, all the remedies for nausea, and, finally, had had a period of rest for several days of the stomach, and has been fed by bowel, but had not retained anything in the bowel for some hours. Physical examination showed a tympanitic abdomen, very tender, and greatly distended. Nothing could be made out by palpation, as there was a high degree of distention.

With practically normal temperature, pulse, and respiration, yet the general appearance of the man indicated that he was in a critical condition. His face was the picture of distress, and was somewhat reddened, cheeks sunken, eyes bright, intellect unimpaired. There was a beady perspiration over his face and his body was clammy. He could move himself about in bed with difficulty.

Believing that he had a gastric ulcer or acute pancreatitis, he was at once transferred to the German Deaconess Hospital and was prepared for operation, which was undertaken the next morning.

He appeared in the morning as he did the night previous, much distressed, and complaining of the great pain in the abdomen; his tongue was dry and the abdomen was distended. I was assisted by Dr. Brown and Dr. Swertfeger. He was given chloroform at first after a few breaths of ethyl chloride, but it was necessary to change to ether after a few moments, as he did not do well under chloroform.

When he was fully narcotized, the abdomen could be palpated; then it was quite evident that the trouble was in the epigastric region rather than below the umbilicus, and accordingly an incision

was made in the median line of the abdomen and the peritoneal cavity was opened for about five inches. As soon as the cavity was opened there flowed from it a small amount of serous fluid, not having the appearance of purulent material, but of a serosanguineous tinge.

There presented immediately under the opening a coil of intestines, which in size would be considered as the colon, but which on examination was found to be small intestine and somewhat enlarged, but the intima showing more thickening than actual enlargement of the diameter of the gut. This was very much congested, almost black, and extended from one end to the other of the necrotic part, about sixteen inches.

The lumen of the gut was not entirely occluded, as it was evident that a certain amount of fluid was being passed along.

I attempted to lift the swollen and necrotic part, but found that the mesentery attached was also so very much thickened that it was not at all flexible, but was so gorged with the inflamed condition that, even when only slight and very gradual movements were made, the peritoneal covering of the mesentery began to bleed. There was some tearing. I examined very carefully, and did not find any evidences of pus in the peritoneal cavity. The gall-bladder was not distended, was not inflamed, was not occluded. The appendix was not inflamed, and there was no evidence of any involvement of the colon at any place. The pancreas was soft and not at all inflamed. The stomach was not attached by adhesions to the place where the gut was inflamed, and there was no evidence of perforation.

This was the second case I had seen, and, knowing that this man was not in good condition, I made careful examination of the surrounding parts and sewed up the wound in the abdomen, returning the man to bed, giving, of course, a very unfavorable prognosis in the case. The man lived until the next day.

In this case, as in the first case cited, the mesentery was hardened into many nodes, which filled the whole width of the mesentery and made it very hard, and not the usual œdematous feeling encountered in the intestine.

The intestine involved is well illustrated in the accom-

panying sketch (Fig. 1), being so nearly black that it was necrotic to all intents and purposes. The whole length of the necrotic mass was delivered after a careful effort; but it was so involved with all the surrounding mass, it was quite out of the question to attempt its removal.

The nodes looked like carcinomatous nodules, but the liver was not involved, and primary carcinoma of the omentum is, of course, unknown, and is seldom found in the mesentery, and then unless extending from the involved organs near at hand.

The first case had at the time I saw him first no temperature, but had a pulse of 140, while this man at no time had either any increase in the pulse or in the temperature. When he was admitted to the hospital his temperature was 99° F., and his pulse was 76.

They were both undoubtedly cases of gangrene of the intestine following thrombus of the mesenteric artery, or rather the branch that supplied this part of the intestine. There was a well-marked line in both instances; the greater part of the intestines were of normal color and consistency. The colon was in both cases normal in appearance, and in neither case did there appear any blood in the vomitus or in the stools.

In one case there was a well-recognized case of syphilis, and in the other case the arteries were hardened, and the man had been a steady drinker for a number of years. In each case there had been a period of sickness preceding the attack, each had been constipated, each had a period of gastritis followed by intense abdominal pain, vomiting, tympanites, distention, tumefaction, both presented the same appearance of the bowel, one was resected and one was not, and both died.

The third case presented the same appearances, but had a different etiology, and was a more favorable subject.

On November 4, 1902, I was asked by Dr. C. M. Brown to see with him Joe F., aged nine years, the eighth healthy child of healthy but hard-working parents. At the time I saw him he gave no history of injury, but it was stated to me (as it had been to Dr. Brown before me) that the boy was all right four days before this,

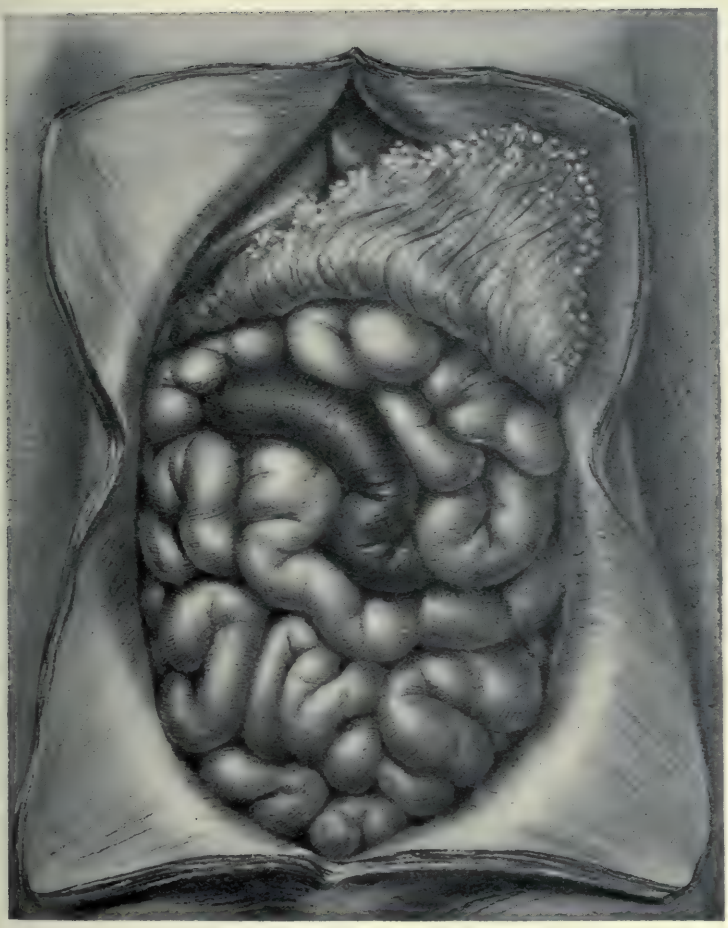


FIG. 1.—Illustrating the appearance of the abdominal cavity in Case II, in which one coil of the small intestine was totally black, and yet was surrounded by other coils of normal color.

when he suddenly was taken with the colic and his abdomen became very sore, and his every movement was a source of pain to him. Dr. Brown had treated him by giving him anodynes for a short time until the great prostration had worn away, and then he had given him a liberal portion of physic, and he had apparently improved, until the day previous to my seeing him, when he had developed great tenderness in the abdomen.

He had vomited a great deal and was very tender all over the abdomen; there was no rigidity of the muscles, and no localized tenderness except that perhaps a little more tenderness was shown over the umbilicus. I might say here that after the operation the boy seemed in a precarious condition for some time, and there was not forthcoming an explanation of his condition, and the boy's grit was somewhat weakened by his suffering. He confessed to his mother, that the day before he was taken sick he had purloined the football of some of his playmates, and that after it was discovered, two of them caught him in a lonely field, threw him down, and, while the one held him, the other kicked him with all his might in the "belly" several times, and that it was after this experience that he staggered home with the attack of colic, but he was game and did not "peach" on the other boys, either on account of his own wrong-doing or on account of his idea of "grit." I had him sent at once to the "Sisters' Hospital" and prepared for operation, and with the assistance of Dr. Brown and Dr. Riley I opened the abdominal cavity, and in this case as in the other cases found about eighteen inches of the small intestine very much blackened, necrotic in places, but with the colon intact and not at all involved.

The appendix was a little reddened, but was not involved. The mesentery was in this case, as in the others mentioned, much swollen, thickened, and hard, the lumen of the gut was not increased in diameter, but the walls were much injected, full of serum, blood, and not of pus.

The boy at the time I saw him first had a normal temperature, but a pulse of 120. The appendix was not removed, a bad prognosis was given, but the boy got well and is well to-day.

He had stormy passage, was out of his mind for several weeks, had incontinence of urine and fæces, tore his wound open, passed bloody mucus by bowel for some days, rejected all food, and in general was not promising, but eventually began to keep liquids,

gained some control of his bowels, the bedsores improved, the general tone improved, and finally he was moved home, and after a tedious delay was restored to health and is alive to-day.

I believe all three of the above cases were caused by a thrombus of the artery of the mesentery. The first from a sclerotic artery, consequent on his long alcoholic history, and perhaps from an undiscovered specific taint; the second from sclerotic artery from specific taint with some slight injury from the work which he followed, being a cooper, or perhaps from the gastritis and general indisposition under which he had labored for the month previous.

The third from the traumatism resulting from several vigorous kicks in the abdomen administered by his boy friends.

I have seen several men in hospital practice who have died from severe injuries resulting from having heavy bodies fall on them or from having fallen great distances, and the certificate has usually read " internal injuries," and it is usually conceded that this means rupture of the spleen or liver.

However, after seeing these three cases, I am convinced that there are many cases where death is caused by gangrene of the intestine following thrombus, or embolus in sclerotic arteries, and a long alcoholic history, or syphilis coupled with some slight injury or gastritis, or, as in the third case following, extensive bruising of the abdomen. The drawing herewith presented (Fig. 1) was prepared under my direction, and presents the appearance of the first two cases very well.

There was one coil of the intestine that was black; and when further exploration was made, it was seen that the coil extended among the other coils; but as the abdomen was opened, the one black coil was of such appearance in comparison with the rest as the illustration shows.

RESULTS IN ABDOMINAL WALL SUTURE.[1]

BY CHARLES DAVISON, M.D.,

OF CHICAGO.

AFTER a laparotomy, the abdominal wound to be ideal must be neat in appearance, accurate in apposition of tissue, sterile in healing, and strong in the resulting scar.

Some time ago the writer proposed the fastening of a longitudinal silkworm-gut suture in the fascia of the abdominal wall by terminal bow-knots, leaving the ends of the suture protruding from the wound. The knots to be untied by traction on the exposed ends and the suture removed at the completion of the process of healing.

A complete series of forty-one consecutive cases with sterile primary union was reported at that time.[1]

The aim of this simple manipulation was to obtain all of the advantages and security of close and accurate suture of the individual layers of the abdominal wall without the danger of suppuration incident to the use of catgut and its pulpification and absorption, and without the dangers of irritation and sinus following the use of any permanent buried suture. Silkworm gut can be made absolutely sterile; it can be boiled in water any length of time without injury; its texture is practically impervious to the entrance of germs; and it does not in itself furnish a culture medium for the growth of pyogenic bacteria.

Silkworm gut can be removed after any method of longitudinal suture in which the perforations in the fascia practically assume a straight line when traction is made on the suture.

If a form of suture is used which surrounds tissue, as the glover's or over-and-over stitch, it will bind, and be difficult or impossible to remove it.

Model "A" shows the method of application of a fastened longitudinal herring-bone suture of the linea alba, which produces edge-to-edge approximation of the cut fascia.

[1] Read before the Chicago Surgical Society, April 4, 1904.

Model " B" shows the method of application of a fastened basting suture, which produces a flap approximation of tissue, applicable to the Bassini operation for inguinal hernia or to the Mayo operation for umbilical hernia.

The aim of every surgeon is to close his laparotomy wound in such a manner that he will get (1) Sterile healing of the wound, (2) close and accurate union of the strong fascia, (3) no postoperative ventral hernias.

The ultimate object is to obtain a scar so well placed and so strong as to prevent postoperative ventral hernia as long as the patient may live.

It is along these lines that methods should be compared.

1. *Sterility.*—Abel's analysis of the cases occurring in the Leipzig Gynæcological Clinic for four years shows 280 cases of catgut fascia suture with fifty-two infections, or 18 per cent. of infections.[2]

The writer has used the tied longitudinal silkworm-gut suture in all clean laparotomies during the three years 1901–3.

The results are as follows: One hundred and seventy-eight cases with seven infections, or less than 4 per cent. of infections.

Of these cases, twenty-three were emergencies, operated upon without previous preparation, with four cases showing infection, all limited to the subcutaneous fat.

The remaining 155 cases had hospital preparation previous to the operation, with three cases of infection, or less than 2 per cent. of suppuration in the prepared cases.

The reports by Haggard,[3] Bell,[4] Hamilton,[5] and others sustain the position that the use of a removable buried silkworm-gut suture lessens the danger of abdominal wound suppuration.

2. *Approximation of Fascia.*—After the process of cicatrization has been completed, a close union of the fascia by a minimum amount of scar tissue, with no interposition of peritoneum muscle or fat, is the ideal prophylactic against postoperation ventral hernia. In one of my cases a secondary laparotomy was required. The fascial stitch was allowed to

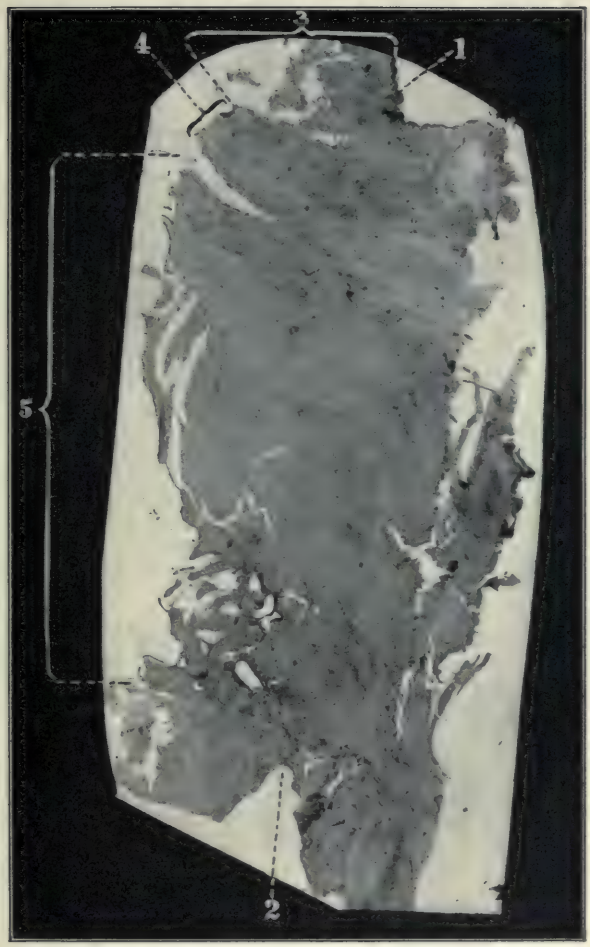


FIG. 1.—Cross-section of scar three weeks after operation; magnified four diameters. 1. Skin incision. 2. Peritoneal incision; scar line between 1 and 2. 3. Skin and subcutaneous fat. 4. Fascia over rectus muscle. 5. Rectus muscle.



FIG. 2.—Cross-section of scar in fascia, magnified seventy diameters. 1. Fascia. 2. Location of silkworm gut. 3. Inflammatory material. 4. Muscle.

remain three weeks, when the entire scar containing the stitch was dissected out. Cross-sections of the scar for microscopical examination were made by Professor W. A. Evans and microphotographs by Dr. Gramm.

The laparotomy wound was made through the right rectus muscle and the tied suture was in the fascia covering the muscle.

Microphotographs (Figs. 1 and 2) show for themselves the closeness of the union of the fascia and the small amount of inflammatory tissue present.

3. *Postoperative Ventral Hernia.*—Freedom from postoperative ventral hernia is the final test of all methods of abdominal suture. Probably the most accurate comparative statistics that we have on the subject are those compiled by Abel.[2]

Abel concludes that hernia is not due to conditions of the abdominal wall, but depends on the closeness of union of the fascia and the manner of healing of the wound. According to Abel's tables, fewer hernias followed fascial suture by catgut than by any other method of abdominal wound closure in use at that clinic. He gives 224 clean cases followed by twenty hernias, or 8.9 per cent., and fifty-two infected cases followed by sixteen hernias, or 31 per cent. A total of 276 cases of fascial catgut suture followed by thirty-six hernias, or 13 per cent. The best showing was made by cumol catgut with fifty cases followed by three hernias, or 6 per cent. Of the writer's 178 cases of removable silkworm-gut suture, 131 have been followed up to the time of the preparation of this report. One case of spontaneous epigastric hernia operated upon by Mayo's method had a recurrence of hernia two inches from the old line of incision five months after operation.

Three-fourths of 1 per cent. of postoperative ventral hernias.

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A POSTERIOR INCISION IN CERTAIN APPENDICITIS OPERATIONS.

BY JOHN G. SHELDON, M.D.,

OF TELLURIDE, COLORADO.

THE operation that I shall describe is one in which the appendix is reached through Petit's triangle. A vertical incision is made along the outer border of the latissimus dorsi and extends from the crest of the ilium upward. This exposes the outer border of the quadratus lumborum and the lumbar fascia and aponeurosis of the transversalis, which extend anteriorly from the outer border of the muscle. The second incision is made transversely, close to the iliac crest, through the lumbar fascia and transversalis, exposing the parietal peritoneum directly over the ascending colon and cæcum.

A glance at the anatomy and pathology of the appendix will show that the foregoing method of operative procedure may be especially advantageous in treating an inflamed appendix or its most frequent complication, a localized abscess. The appendix, cæcum, and ascending colon lie on the posterior parietal peritoneum. The outer border of the quadratus lumborum muscle overlaps the inner one-half of the ascending colon, while the outer portion of this viscus projects beyond the border of the muscle into the triangle of Petit. The appendix, in the majority of cases, is found behind the cæcum, with its tip pointing upward. When the patient is lying in a straight position, the appendix is below the line of incision; but I have found that when the patient is placed in the lateroprone position, with a large pad under the loin, the cæcum protrudes into the angle between the crest of the ilium and the outer border of the quadratus lumborum muscle.

In cases with pus formation, the abscess is found directly in contact with the cæcum (Bloodgood [1] reports a case, contrary to this statement, which will be discussed later), and can

be opened more quickly, more easily, and with less danger, through a posterior incision than by any other route. Posterior drainage, as herewith advised, opens the abscess in the most dependent part, and thoroughly drains retroperitoneal infection. In chronic cases, with many and firm adhesions, I have found the operation, through the posterior incision, easier and more rapid than when the incision is made as is ordinarily advised. In this connection, I refer to operations for removal of the appendix. Of course, if operation is required for intestinal obstruction, following adhesions, the posterior incision would in most cases be inadequate and should not be advised.

Description of the Operation.—Position of the patient. The patient is placed on the left side and a large support put under the left loin. This brings the right loin into a favorable position for operation, and lengthens the distance between the right costal arch and the iliac crest. It also brings the appendix nearer the incision by depressing the right side of the pelvis.

The incision. An incision is made from a point one-half an inch behind the highest point of the crest of the ilium towards the tip of the twelfth rib. The length of the incision depends on the obesity and the body form of the patient. The anterior border of the latissimus dorsi muscle is located, freed by blunt dissection, and retracted posteriorly. This exposes the outer border of the quadratus lumborum muscle, the lumbar fascia, and the aponeurosis of the transversalis. A transverse incision, one-half to one inch above the crest of the ilium, is then made. This incision begins at the outer border of the quadratus lumborum and extends forward, parallel to the fibres of the transversalis, as far as is necessary to secure sufficient room to operate quickly. I usually separate the fibres of the transversalis by blunt dissection. The subperitoneal fat, which, in some cases, is quite abundant, is pushed aside with the finger covered with a piece of gauze. The peritoneum is opened near the forward part of the incision and the peritoneal incision enlarged in a posterior direction. On opening the peritoneum, the cæcum presents itself in the wound. The remainder of the operation does not require description. In cases where

drainage is not necessary, the wound is sutured, in layers, with catgut and silkworm gut.

The vessels and nerves, in relation to the field of operation, are as follows:

The iliac branch of the iliohypogastric nerve pierces the external oblique and is anterior to the line of incision. The main trunk of the iliohypogastric lies above the incision in the transversalis in most cases. Its course is parallel to the fibres of the transversalis; and, if the fibres of the transversalis are separated by blunt dissection, the nerve is not injured. The ilioinguinal follows the same direction as does the iliohypogastric, and is avoided in the same manner. The anterior branch of the last dorsal nerve is, at the site of the operation, internal to the transversalis and is a considerable distance above the transverse incision. The lateral cutaneous branch of the last dorsal nerve is given off anteriorly to the posterior border of the external oblique, and is not in the operative field.

There are no arteries or veins of sufficient size or importance close to the incision. I have never found it necessary to ligate a vessel in doing this operation; and seldom has it been necessary to use hæmostats to check temporary bleeding.

Advantages of the Method.—In clean cases, the operation has few advantages over the method ordinarily employed. In obese cases the posterior operation is more rapid, and is less likely to be followed by hernia. In all cases, I have found the operation, as herewith described, followed by less shock and abdominal distress than a laparotomy through an anterior incision.

In cases with abscess formation, and in all cases requiring drainage, I have found operation through the posterior incision preferable to the old method. The abscess is opened in the most dependent part, and the infected area is reached and treated without coming in contact with the omentum or small intestines. Retroperitoneal infection, which is quite a common and, according to Stone,[1] serious complication, is drained much more efficiently than is possible through an anterior incision. It has been my experience that infected cases, when drained by the

posterior operation, heal very rapidly as compared with similar cases drained anteriorly. When a posterior incision is used, patients can be permitted to leave the bed at an earlier date, and with less liability to postoperative hernia, than if they had been operated through an anterior incision. It is seldom that herniæ follow operations for appendicitis through an anterior incision, but they do occur. I have had one case, a pus case drained anteriorly. Taylor [2] and Rodman [3] each report a case of hernia following clean operations.

Disadvantages of the Method.—I have operated on fifty-eight cases by this method and have found no disadvantages. During my first cases, I was fearful that I should experience great difficulty in operating on patients in whom the cæcum and appendix were fixed by a short mesentery. I have operated two such cases by the posterior method, and found the operation less difficult than are operations on similar cases through an anterior incision.

J. C. Bloodgood [4] reports a suppurative case that would not be suitable for the posterior incision. In this patient the abscess was between the folds of the mesentery of the small intestines. These cases, doubtless, are very rare, and are exceptions to the rule.

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INFLAMED APPENDIX IN THE SAC OF A FEMORAL HERNIA.[1]

BY AURELIUS RIVES SHANDS, M.D.,

OF WASHINGTON, D. C.

MRS. O., a widow, aged twenty-nine years, mother of one child, now seven years old, a very robust woman, who has always enjoyed exceptionally good health, first noticed a swelling in her right groin four years ago; it had developed very gradually, and, as it had given her little or no pain or inconvenience and had always disappeared when in a recumbent position, she gave it little or no thought until the latter part of October, 1903, when she noticed it was increasing very rapidly in size and was very painful to the touch, and did not disappear when in a recumbent position as formerly.

She consulted Dr. L. S. Savage on October 31, 1903. At that time he found the condition above described, and that she had a temperature of 101° F. I saw her in consultation with Dr. Savage the next day, and diagnosed the case as one of incarcerated femoral hernia, and advised an early operation, not urging an immediate operation, as there were no symptoms of strangulation. The hernia was about the size of a duck's egg, and was in somewhat the shape of an hour-glass; this was due to a constricting band around the mass. The hernia was very tense and extremely painful on the slightest manipulation, and apparently irreducible by manipulation. Her temperature was 100° F. at that time.

She was admitted to Sibley Hospital on November 2, and was operated on the morning of the 3d.

Through the usual incision for operating for femoral hernia, the hernial protuberance was easily enucleated from the surrounding structures *en masse,* exposing the neck of the sac at the point of its exit from the femoral ring. Upon opening the hernial sac there was a gush of peritoneal fluid, which was confined under considerable pressure. There was neither intestine nor omentum

[1] Read before the Medical Society of the District of Columbia, December 8, 1903.

in the sac, but firmly adherent on the side was the appendix cæci with the distal end ulcerated and much enlarged. Upon examination, it was readily seen that the internal membrane presented a condition of acute peritonitis extending to the lumen of the neck of the sac, whose walls were closely adherent, the result of the inflammatory condition, thus confining the peritoneal fluid to the hernial sac and protecting the general peritoneal cavity from the peritonitis.

After separating the appendix from its adhesions, it was amputated in the usual way, and the wound was closed as for a radical cure for femoral hernia. Primary union resulted; the patient made an excellent recovery, and left the hospital at the end of two weeks.

It would seem that nothing new could be added to the subject of appendicitis; nevertheless, this case does offer something entirely new, in that the appendix was accidentally found presenting all of the characteristic clinical features of an acute appendicitis outside of the abdominal cavity.

After exhausting, with a negative result, every resource at my command to ascertain if ever such a case had been recorded, I wrote to Dr. W. B. Coley, of New York, who has probably operated on more cases of hernia than any surgeon in this country, to know if he had ever encountered such a case. The following is from his reply:

"I have never personally found the appendix in a sac of a femoral hernia, although I have seen it a good many times in inguinal hernia, once on the left side. I also saw Dr. Carl Beck operate on a case of irreducible femoral hernia some years ago, in which the appendix was found in the sac, though there were no symptoms of strangulation or incarceration in this case.

"I think your case must be very *nearly unique*. I have recently operated upon a similar case, an inguinal hernia in the female, in which the appendix was incarcerated and much inflamed."

A RADICAL OPERATION FOR MALIGNANT NEOPLASM OF THE URINARY BLADDER.

BY ALBERT ASHTON BERG, M.D.,

OF NEW YORK,

Adjunct Surgeon to Mount Sinai Hospital.

RADICAL operation for malignant disease means a complete removal of the primary carcinoma, together with all the infected lymphatics and glands. The prognosis for lasting cure depends entirely upon the thoroughness with which the excision is done. In all the operations that are performed for malignant neoplasm of the urinary bladder, no attention is given to the thorough removal of the internal iliac lymphatics and glands. These procedures can consequently not be considered as radical, nor as holding out any hope for permanent cure of the disease.

The writer begs to propose the following operation as being a radical one for removing malignant growths of the bladder, together with the glands and lymphatics; it is especially applicable to new growths involving the posterior wall and bas-fond of this viscus.

The ureters are both catheterized before the anæsthesia is commenced.

The abdomen and genitals are thoroughly shaved and cleansed the day before the operation.

Under full anæsthesia, a three-inch incision is made in the median line of the abdomen, from just above the symphysis pubis upward. The patient is at once put into the Trendelenburg position, and the small intestines carefully packed away and the general peritoneal cavity protected by large, warm, moist compresses. Over these compresses a second layer of dried gauze pads is placed. The small pelvis is thus freely exposed.

The peritoneum of the pelvic floor is now divided straight across,—in the female at its reflection from the posterior vesical surface on to the cervix uteri, and in the male at the anterior aspect of Douglas's cul-de-sac. The peritoneum is then bluntly raised up from the pelvic floor to the level of the bifurcation of the common iliac artery, where the ureter, with its contained catheter, is easily identified lying adherent to the peritoneum. The ureter can be at once traced downward to the bladder, and its position carefully noted. The glands and lymphatics along the internal iliac artery, together with the surrounding loose cellular tissue, are dissected out on either side down to the bladder-wall. This step in the operation may be attended with considerable venous hæmorrhage, especially near the bladder. The hæmorrhage is easily controlled by packing; if the dissection has been bluntly carried out, the bleeding will never be very copious. The important structures that are encountered are the ureters, previously identified, the internal iliac artery and vein, which are easily recognized and avoided, the uterine artery in the female, crossing the ureter at upper level of the cervix; the seminal vesicals and vas in the male.

The prostatic plexus of veins in the male lie below and behind the field of operation, and should not be encountered unless the prostate is involved in the malignant disease.

Should the ureter be involved in the cancerous growth, it should be dissected out along with the glands and lymphatics, and preparations made for its resection and subsequent implantation into the bladder. It is to be especially noted in dissection of the ureter that it is not to be too closely stripped from its cellular bed; for its blood supply is derived from this cellular tissue, and, if it is stripped too closely, it may necrose.

The infiltrated glands and lymphatics being removed, the cellular space of the pelvic floor is loosely tamponed with gauze. This checks oozing and prevents infection. The peritoneal packings are carefully inspected and arranged to prevent soiling of the peritoneum.

The bladder is now opened in healthy tissue, just above the upper limit of the neoplasm. The cavity of the bladder

is at once dried out with *sponges,* and the surface of the neoplasm thoroughly cauterized with pure carbolic acid or the actual cautery.

The neoplasm is now widely excised; if the lower end of the ureter is diseased, it should be removed. Hæmorrhage of the bladder-wall is easily controlled by pressure forceps or ligature.

If the ureter has been partly excised, its proximal end should be now implanted into the summit of the bladder, either intraperitoneally or extraperitoneally. It is best not to implant the ureter into the line of the excised area, for the union at the meeting-point of the suture lines is apt to be imperfect, and leakages occur.

The defect of the bladder-wall is now repaired by two rows of sutures,—catgut for the mucosa, and silk, passed Cushing mattress fashion, for the muscularis.

Drainage of the entire pelvic floor by gauze. In the female the gauze is conducted out through the vagina, in the male through a counterperineal incision, between the rectum and the prostate.

The pelvic peritoneum is completely closed over the gauze drainage. Closure of the abdominal wound without drainage.

The advantages of this operation may be summed up as follows:

It affords the freest access of any to carcinoma of the posterior wall and base of the bladder.

It is the only method by which the indurated lymphatics and glands along the internal iliac artery can be removed.

It permits us to remove the ureter when diseased, and to at once reimplant it into the bladder or into the opposite ureter.

It allows of accurate suture of the defect created in the bladder-wall.

It permits of excellent drainage below.

The objections that may be raised to it are that we expose the patient to graver risks of infection than by the extraperitoneal method of resection. This cannot be denied; but, as it is impossible to remove the glands and lymphatics by the extra-

peritoneal method, we must either give up all attempts at radical cure of vesical carcinomata or resort to the intraperitoneal method as outlined above.

The danger of infection can be reduced to a minimum. The bladder is not opened until the glands and lymphatics and cancerous tissue in the pelvic floor have been dissected free; the cellular tissue is then covered by iodoform gauze. As soon as the bladder is opened, it is sponged dry and the surface of the neoplasm at once thoroughly seared with the actual cautery or pure carbolic acid.

Very little blood is lost during the operation. As there is no exposure nor handling of the intestines, there is no shock, even though the operation is a lengthy one. In the author's two cases, the patients suffered no shock, although the operation lasted three hours and two and one-half hours respectively.

The writer recognizes that the dissection in the pelvic floor is not an easy one. But if at the very beginning of the operation the pelvic peritoneum is bluntly peeled up to the level of the common iliac bifurcation, and the ureter there identified and traced downward, the dissection is much simpler and can be more quickly done. The introduction of the ureteral catheters simplifies the identification of the ureters.

The writer feels that the possibility of effecting a lasting cure justified the proposal of this operation. Either we must remove the glands and lymphatics together with the neoplasm, or else give up the hope of curing our patients.

In the past year the writer has had occasion to practise this operation in two patients.

In the first patient, a woman of thirty-two, the carcinoma of the bladder complicated an advanced carcinoma of the uterus, vagina, and both broad ligaments. Only the young age of the woman prompted the writer to attempt radical cure. Hysterectomy and complete excision of the internal iliac lymphatics and glands were first done. Then the left side of bas-fond, left posterior surface, and left ureteral orifice of the bladder were removed. Immediate implantation of the left ureter into the summit of the bladder, without tension. The bladder defect was

closed by two rows of sutures. Drainage of entire pelvic floor through vagina; complete closure of pelvic peritoneum and of abdomen. Uninterrupted convalescence; eight months later recurrence in the pelvis. The patient had gained twenty-five pounds; she lost five pounds in the last two months

The second patient was likewise a woman. Extensive carcinoma of right posterior wall and right side of base and right ureteral orifice, complicated by bleeding uterine fibroids. Preliminary hysterectomy; removal of internal iliac glands and lymphatics was easily accomplished. When bladder was opened, the carcinoma was found to extend into the urethra. Wide excision would have necessitated removal of posterior one-third of urethra, with consequent incontinence. The exposure was excellent. Excision would have been very easy. In view of the extensive involvement of the disease, with the possibility of establishing incontinence of urine if excision was done, the writer was led to abandon his original purpose of doing a radical excision. The entire carcinoma mass was therefore destroyed with the actual cautery. Permanent catheter in bladder. Closure of opening into the bladder by a double row of sutures. Drainage per vaginam. Closure of pelvic peritoneum and abdominal wound without drainage. Uninterrupted convalescence.

The writer was at this second operation impressed with the excellent exposure, and the easy access afforded to the glands, lymphatics, and posterior wall and base of the bladder.

REPAIR OF THE URETHRA BY TRANSPLANTATION OF THE URETHRA OF ANIMALS.

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Surgeon to the Royal Infirmary.

THE object of this paper is to describe some cases, three in number, in which patients with defects of the urethra have been treated by grafting into their tissues portions of the urethra of the ox.

Two of the patients so treated were men who had sustained a complete and extensive rupture of the urethra in the perineum; while the third was a boy with hypospadias, in whom there was a deficiency of the floor of the urethra for the whole of the penile portion of the channel.

It is not my purpose to enter fully and in detail into the various methods of treatment that have been proposed or adopted by different surgeons to effect a cure in similar cases; but it will be necessary to refer to some of these, and to say a few words regarding the condition of the parts which renders such methods of treatment necessary.

Complete transverse rupture of the urethra is an injury that, *per se,* may be associated with many complications of such grave importance as to elevate it to the rank of an accident of the first magnitude. These complications may be primary; in which case they are mainly dependent on the state of the urine at the time of the injury and its extravasation into the tissues around the rupture, or they are secondary, and in that case are associated with the healing process. For it may be laid down as an axiom that, unless the rupture is repaired by the union of urethral epithelium, a "splice" between the two portions of the canal by the formation of cicatricial tissue is unavoidable, so that the ultimate result to the patient is a stricture of the most intractable nature associated with all the ill effects of

backward pressure throughout the entire urinary tract posterior to it.

The question, therefore, as to the treatment required for this condition is one of great importance and of much practical interest.

In recent cases, provided that a large extent of the urethra is not actually destroyed by the contusing violence, the treatment is easy, and consists of exposing the ends of the two portions of the urethra and bringing them into accurate apposition by suture. Even in cases where a certain extent of the urethra is destroyed, the tissues which enter into the formation of the channel are so elastic as to permit of them being stretched over a considerable gap if they are sufficiently freed by dissection.

But there is difficulty in connection with these cases where the trauma has involved a considerable extent (length) of the urethral walls, or where sepsis has been followed by suppuration round the divided urethra; for by either of these processes necrosis of tissue is brought about and the suture of the two ends of the urethra rendered impossible or futile. Attempts to remedy the condition in such cases may be carried out on the following lines:

1. Guyon (*Gazette Hebdom.*, No. 20, 1892) advocates treatment of these cases by allowing the urethral tissues to regenerate from the two ends. He does not make any attempt to bring the ends together; they are merely freed from their surroundings; a soft catheter is passed into the bladder, and over this the tissues of the perineum are sutured: the catheter is allowed to remain in from two to four days, and after that time the patient is allowed to pass urine in the natural manner. It is claimed that from the ends of the urethra a regeneration of the mucous membrane will take place, and eventually line the channel formed between them by the suturing of the soft parts over the catheter.

Indeed, Ingianni (*Gaz. dell. Ospedale et della Clin.*, 1898, No. 127) (to whose original paper I have not access, though a brief quotation of it and the conclusions arrived at are given in

Centralb. für Chirurgie, No. 6, 1899) claims, from a series of experiments carried out on dogs,—

(1) That a longer or shorter urethra can be produced.

(2) That both mucous membrane and cavernous tissue are reproduced, but not muscular tissue.

(3) That the reproduction takes place by the growth of a granulation tissue around the catheter from the ends of the urethra.

(4) It takes place faster where there is little postoperative inflammatory state.

(5) After fifteen to thirty days the new canal shrinks a little, but is only exceptionally obliterated.

Guyon in the above-mentioned paper briefly records three cases of traumatic stricture treated in this manner, but does not state what extent of the urethra was excised in any one of them. He makes the rather surprising statement that contact of urine, whether normal or pathological, does not harm the process of cicatrization. One would have thought that septic urine passing over a wound recently made and sutured would be liable to infect it.

2. By grafting the wound with skin or mucous membrane, the grafts being cut by Thiersch's method; or, by transplanting flaps of the same tissues.

Gersuny employed the latter method (transplantation) with apparently a good result (Report by Mrha, *Wien. klin. Wochenschrift,* 1898).

Wölfer (*Arch. klin. Chirurgie,* 1888) grafted a wound with the mucous membrane obtained from the vagina in a case of prolapse of the uterus, and the inner layer of the prepuce has been used by several surgeons for the same purpose (Meusel, Weir).

I believe that actually all these methods have been employed only in the treatment of cases of old standing and where a stricture of the canal was present. I am not aware of any case having been published where either line of treatment was made use of at a time when the case could be said to be "recent," *i.e.,* before the urethra had been "spliced" by the

formation of an isthmus of cicatricial tissue between the two portions.

I have myself, however, treated with success a case of this kind by employing a skin flap; but skin does not appear to me to be a satisfactory material to employ for the purpose of making a channel to conduct urine. Skin is very easily irritated and inflamed by the constant bathing with urine. One has only to consider the effects on the skin of the scrotum and perineum in cases of incontinence of urine to be reminded of this fact.

Still, in some cases it may be the only tissue that one can employ, as in my case above referred to. Mucous membrane is probably a much better material for this purpose than skin, but is not always available at the time one requires it. In any case the employment of either of these substances entails at least two operations,—one for the purpose of making the graft, and a second for the conversion of the graft, after it has become adherent in its new situation, into a canal. It appeared to me, therefore, that, provided the grafts would live, it might be possible to treat these cases by implanting a portion of the urethra obtained from some animal; the advantage of this procedure being that not only was a complete channel obtained that could be buried in the tissues at one operation, but a channel lined with a mucous membrane prepared for conducting urine over its surface.

I have adopted this procedure on five occasions now in the cases of three patients, choosing for the purpose the urethra of a bullock, for, although the urine of the herbivora is alkaline, it was thought this factor might be neglected, as the difficulty of obtaining a urethra of a satisfactory diameter from an animal secreting acid urine is very considerable.

The following are the notes of the cases:

CASE I.—J. C., aged fifty-one years, but looks at least ten years older, was admitted to my ward in the Glasgow Royal Infirmary about midnight, December 2, 1900, on account of retention of urine.

He has been a heavy drinker, and was intoxicated at the onset of the retention two days before admission, since then only very small quantities of urine have been passed. A medical man had seen him on two occasions, and each time tried to pass soft instruments into the bladder, but failed to do so. On the day of admission the penis began to swell and no urine had been passed. On admission he was very exhausted, the penis was slightly swollen, the prepuce œdematous; at the penoscrotal junction the tissues had a slightly bruised appearance, the prostate was not abnormally large, the bladder reached to the umbilicus.

An instrument could not be passed into the bladder; at a point two inches from the meatus an obstruction was encountered which was impassable, so the bladder was aspirated and a large quantity of blood-stained urine drawn off. The following morning, on palpating the parts, I found a crackling sensation in the tissues at the penoscrotal junction, so made a free incision there, but the tissues only appeared to be bruised. Another incision was made in the perineum and a cavity opened into, which contained foul-smelling blood and urine, and the condition of the tissues was suggestive of traumatic rupture of the urethra. I could not find the proximal end of the urethra, so made a suprapubic cystostomy, washed out the bladder, which contained ammoniacal urine and blood, and passing a bougie from the bladder into the urethra found the latter to be destroyed from the apex of the prostate forward to the level of the triangular ligament, at least. I was still unable to pass an instrument through the penile urethra, but, hoping that the incision made there would relieve tension, I did not persist in the attempt. The wounds were dressed with moist dressings and the bladder drained by Cathcart's siphon apparatus. The discharge continued very offensive, and it was soon obvious that a large amount of tissue had sloughed, so the scrotum was split in the middle line, and it was found that the corpus spongiosum was completely gangrenous from the triangular ligament to a point five centimetres from the meatus of the urethra; this was all cut away, and a very large wound was left with a correspondingly large gap in the urethra; only the prostatic portion and a piece five centimetres long at the other end remaining.

The patient improved rapidly after this, and I decided to attempt to supply the defect in the urethra by a graft. This was done January 14, 1901. A portion of the penis of a young bullock

just killed was obtained at the slaughter-house and conveyed to the Royal Infirmary in hot sterile saline solution; the urethra was dissected out, leaving only a few alveoli of spongy tissue attached to it.

The patient's wound was then prepared, the ends of the urethra freed sufficiently to enable them to be sutured to the graft, and a portion of the bullock's urethra thirteen centimetres in length stitched in position. The wound was closed by buried and superficial stitches. It all healed absolutely by primary union except at the junction of the graft with the remaining portion of the penile urethra, there these two failed to unite, and a fistula resulted.

February 2, 1901, nineteen days after the implantation, I passed a No. 6 English bougie through the implanted urethra into the bladder easily, then freshened and sutured the ends of the urethra at the fistula again. Several times after this operation (although it was not intended that he should do so) urine was passed along the whole length of the urethra; but eventually the sutured part broke down again, and this was followed by some narrowing of the "graft" at the penoscrotal junction, so on March 26, 1901, I split the scrotum again, dissected out the most distal part of the graft, and implanted (a second time) 7.5 centimetres of a bullock's urethra obtained as on the former occasion: it all remained viable, and the wound healed perfectly, but the junction of the new graft with the (original) penile urethra again failed, and, although it was operated upon several times and always held for a time, it always gave way eventually.

He was finally dismissed July 23, 1901, passing all the urine by the fistula, but able to do so in the erect attitude. Since then he has been seen from time to time; he can retain urine from one and a half to two hours, and has complete control of the bladder. He passes urine through the whole length of the implanted urethra.

During 1903 he has had several attacks of retention of urine, due, I think, to the state of his bladder rather than to that of the urethra, for we can always get a catheter into the bladder with ease.

A second case was treated in a similar manner last year.

Case II.—L. S., aged twenty-eight years, admitted to the Glasgow Royal Infirmary, August 1, 1903, late at night. At about

9 A.M. that day he fell on the footplate of a locomotive, striking his perineum; he bled freely from the meatus, and shortly after the injury attempted to pass urine; none came by the meatus, but he was seized with intense pain and fainted. A medical man saw him shortly afterwards, and attempted to pass an instrument into the bladder, but failed.

On admission the patient was a good deal collapsed; blood was oozing slowly from the meatus; there was no sign of bruising or even of fulness in the perineum, but he complained of intense pain there on the slightest pressure. His bladder was distended to about half-way to the umbilicus.

Under anæsthesia I attempted to pass a full-sized instrument into the bladder, but could not get it beyond a point corresponding to the perineoscrotal junction, so I incised the perineum and opened into a large cavity full of blood-clot; the greater portion of the membranous part of the urethra appeared to have been destroyed, and I could not find the proximal end of the urethra, so was obliged to open the bladder above the pubis. A bougie was passed from the bladder, and it was found that the urethra terminated about half an inch in front of the apex of the prostate.

The wound was dressed wet in case it had been infected with the urine, and the bladder drained by a Cathcart siphon.

August 3, 1903. His temperature has been 101° F. or thereabouts all the time, but the perineal wound looked very well; and to-day I freed the distal portion of the urethra and just managed to suture it to the end of proximal portion and closed the wound; but his temperature kept up and the wound broke down; the bladder showed signs of infection even before the wound did (the patient stated that to his knowledge he had no urinary symptoms before his accident, but his bladder condition had made me suspicious from the beginning).

By the end of August, after constant dressing, the perineal wound was clean, but there was a gap of fully five centimetres between the ends of the urethra, and I determined to try and supply the defect by implanting a portion of animal urethra. On September 3, five centimetres fully of the urethra of a young bullock obtained immediately after the animal had been killed were implanted, its ends being sutured to the extremities of the urethra and the wound closed.

The wound healed perfectly, except one minute point just

behind the scrotum; but on September 14, 1903, a No. 7 English bougie was passed easily from the meatus to the bladder. The bladder condition had improved very greatly by this time.

September 21, 1903. He had a sudden desire to pass urine, although the siphon is still in use and some ounces of urine were passed per urethram. No. 7 has been passed every second day easily.

September 23, 1903. His temperature, which has been normal for the last three weeks, rose to-day to 102.4° F. and he vomited, and complained of pain in the region of the right kidney, but on palpation there was no swelling to be felt, though the region is tender. He got rapidly worse, and a swelling having developed in the region of the right renal, my friend Mr. Luke, to whom, for his invaluable assistance at these, and all my operations, I am continuously indebted, in my absence performed a nephrotomy and evacuated a good deal of pus from the kidney, but the patient did not improve; he gradually became comatose and died September 29, 1903.

At the post-mortem examination it was found there were numerous small abscesses in the cortex of the right kidney, mostly arranged in groups. The pelvis of the kidney contained several small calculi, and the right ureter was blocked by a calculus just above the level of the pelvic brim. The left kidney and ureter were healthy.

Case III.—*Penile Hypospadias treated by Grafting a Portion of a Bullock's Urethra.*

A boy, aged fourteen years, was admitted to the Glasgow Royal Infirmary, January 13, 1902. The penis is greatly curved downward, the urethra terminates just anterior to the penoscrotal junction, and all the urine issues here. He is obliged to sit down to pass urine, owing to the curved condition of the penis; the line of the penile urethra is occupied by many little tags of skin. There is no frenum and no meatus in the glans.

January 30. After making a perineal fistula, the tags of skin were all cut away and the incision extended well into the substance of the erectile tissue, the fibrous sheath of which along with the skin was dissected back at each side as a flap The penis could now be quite straightened. Seven centimetres of a bullock's urethra treated as in the other cases were then sutured into the groove made in the penis and to the freshened end of the urethra

posteriorly,—in front it was sutured to the margin of the incision in the glans and the wound closed over it.

It all healed except at the junction of the original urethra and the graft.

March 2, 1903. I passed a No. 3 English bougie the whole length of the urethra into the bladder and also closed the fistula, but this failed, and so did a second attempt. The patient about this time had several epileptic fits, which we found he had suffered from before admission.

His friends now removed him from hospital, and would not permit further treatment, but up to the time he left I could pass a No. 4 bougie from the meatus into the bladder.

He was not seen again until September 18, 1903, when he came back anxious for further treatment. Most of the urine was passing by the perineal fistula, but some also came by the opening in front of the scrotum. A small part of the implanted urethra was seen to be still present and admitted a small bougie, but the meatus was closed.

September 5, 1903. I dissected out the cicatrix of my former operation, cutting well into the erectile tissue, and found that practically the whole of the former graft was not only intact, but permeable. I excised the whole of it, and then implanted fully nine centimetres of a recently killed bullock's urethra, suturing it to the end of the urethra posteriorly and the margin of the glans in front, and closed the wound completely. The graft lived, and the wound healed perfectly except at the junction of the graft with the original urethra at the penoscrotal angle. He had many fits after the operation, which made it a still more difficult matter to keep the penis steady. At the beginning of December I closed the defect at the penoscrotal angle and was able to pass a No. 8 English bougie all the way to the bladder. This operation was successful, and he went out December 29, 1903, after having been taught to pass a bougie himself.

He has been seen frequently since. A No. 6 can be passed easily.

The treatment of these three patients represents five operations in which portions of an animal's urethra, varying in length from five to thirteen centimetres, have been implanted with success, that is to say, the grafted tissue lived and remained

a patent channel. It is true that in two of the patients the procedure required to be done a second time, but in each of them, at the time of the second operation, the tissue which had been grafted on the former occasion was found to be present.

The Figure appended—a microphotograph (for which I am indebted to my friend, Dr. T. H. Bryce) of a section of the graft excised from R. M. after being in the tissues of the penis for nineteen months—shows a perfect canal lined by a normal layer of epithelium.

It was the penile region which gave the trouble in the two patients (J. C. and R. M.), and this was due to the extreme difficulty there is in adequately maintaining this part in a state of rest. Further, in the case of R. M., we had the recurring epileptic seizures as an additional source of disturbance of the parts.

But where the graft was placed in the perineal region the result was excellent. In the specimen obtained at the post-mortem examination of L. S., it is hardly possible to make out the line of union of the mucous membrane of the graft with that of the original urethra, the channel is so smooth.

So far as I am aware, the procedure constitutes a new method of treating hypospadias; in fact, it was in connection with a case of this kind which I saw nine years ago that the idea of attempting a graft in this way occurred to me, but the patient—an adult—declined any operative proceeding, and I had no opportunity of carrying it out until J. C. came under my care in December, 1900.

Every method of treating hypospadias by operation is uncertain as to the result; for, as in all plastic operations, there is the liability of flaps to slough or of sutures to give way before union has completely taken place; a fistula frequently results somewhere along the course of the new canal. One reads continually in the reports of such cases that before a cure has been effected several operations have been necessary.

This method of implanting a true urethral tube is at least as certain as any other that has been suggested, while the advantage of having a canal ready made, which can be obtained in



Transverse section of the urethral canal excised from Case III nineteen months after implantation.

unlimited quantity and which has been developed for the actual purpose of transmitting urine, is a very great one. And for the same reason it is, I believe, greatly superior to the methods hitherto employed in the treatment of those deficiencies of the urethra which result from traumatic rupture.

A case was recorded in the *Lancet,* Vol. i, 1896, by Clennell Fenwick, in which a portion of a sheep's urethra (the length is not stated) was transplanted in a case of intractable stricture, but I cannot find any other.

THE FORMATION OF AN ARTIFICIAL VAGINA BY INTESTINAL TRANSPLANTATION.

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Of the propriety of establishing a vagina, in cases in which this canal is absent either as a congenital defect or an acquired deformity, there seems to be no question, even when the canal is thus established purely for coitional purposes.

The early operations for this object consisted in making an opening in the cellular tissue between the bladder and the rectum, and attempting to maintain it by the wearing of some form of tampon or plug. These attempts, for reasons which are well understood, uniformly failed.

The more common method of operating consists in taking strips of mucocutaneous and cutaneous tissue from the vulva and internal aspects of the thighs, introducing these strips into a channel previously made between the rectum and bladder, and maintaining them in position by gauze packing until they unite to the cellular tissue, and thus make the opening permanent. Several quite ingenious devices have been resorted to for the purpose of maintaining this apposition.

An important modification of this method was proposed and carried out by Beck, of New York, some five years ago. (Annals of Surgery, October, 1900.) He first made a transverse incision immediately above the symphysis pubis, as though about to make a transverse suprapubic cystotomy. This incision was carried carefully downward between the peritoneum and bladder, hugging the bladder closely, until he reached the space between the bladder and rectum. He then made a counter-opening in the usual way from the perineum to meet the passage which he had already established. In this way he made a canal extending from the perineum to above the pubes,

but without opening the peritoneal cavity. Two skin flaps were then dissected from the thighs, their bases being represented by the labia, and their length being sufficient to extend through the entire length of the newly formed canal. These flaps were then seized with forceps introduced from above, drawn through the canal and fastened by stitches at the upper end, and the suprapubic wound closed. Iodoform gauze was then introduced from below so as to press the flaps laterally against the sides of the passage.

Other operators, acting on the suggestion of Mackenrodt, have endeavored to cover the surface of the new vagina by mucous membrane taken from another patient operated upon at the same clinic, while in a case recently reported the surgeon was able to line the new canal with the inverted mucous membrane of an enormously hypertrophied clitoris which he amputated at the same time.

Sneguireff (*Arch. de Tocol. et de Gynæc.*, Paris, 1892) reports a case in which he utilized a portion of the rectum in the formation of a new vagina. His operation consisted in making an incision through the skin and subjacent tissues along the border of the lower portion of the sacrum and coccyx to the posterior border of the anus. The coccyx was resected transversely across the incision, and with the finger the rectum was separated from the anterior face of the coccyx. The gut was stripped from its surrounding parts, drawn into the incision, and ligated in two places and cut. The superior portion was separated from the bladder and its environments, drawn down to the base and sutured to the right of the resected coccyx. It (*i.e.*, the superior segment of the rectum) was found surrounded by some fibres of the levator ani, and these were secured with it to act as a third anal sphincter. The inferior segment was brought down and its upper end closed by continuous suture, forming the cul-de-sac or cavity of the new vagina. The results of the operation were excellent, and union took place *per primam*. Fourteen days later, a second operation was done for the formation of the vulvar opening. This consisted in making an incision through the fibrous ring situated

between the anus and lower border of the urethra, uniting the rectal mucous membrane by continuous suture to the adjacent parts, and transforming the circular opening into a longitudinal one, surrounded by the labia minora and presenting a striking resemblance to the normal vaginal orifice. Union by first intention. The vagina measured three inches in depth and was capable of a certain amount of contraction. No fæcal incontinence. One year later she wrote that she had perfect control over the bowels and flatus, and that coition was accomplished in a normal manner. (Just what was done with the anus in this case does not appear from the text of the report, nor from the three cuts which accompany it. Apparently, however, the anus was incised anteriorly, so that with its sphincter it constituted the borders of the posterior portion of the introitus of the new vagina.)

With the possible exception of the operation last described, to inquiries concerning the later history of which the operator has failed to reply, these operations seem to have proven quite generally defective, from the ultimate cicatricial contraction of the new canal. The result in Beck's case was unusually good, but even in that after a few months of marital experience the husband deserted his wife.

Mucous membrane long exposed comes to form a very fair substitute for skin; but the converse of this is not true, and a skin-lined vagina must differ very widely from one lined with a normal mucous membrane.

I was recently consulted in the case of a young woman, nineteen years of age, married a little over a year, who some six months before she consulted me had been delivered at term by instruments and after craniotomy. Following her delivery there had been an apparent sloughing of the entire vagina. Healing had taken place, and the perineum was perfectly smooth, except for a very small sinus, so small and tortuous that the smallest probe could not be inserted. No history was obtainable to determine the extent of the sloughing, and the presumption was that we were dealing with a partial atresia of the vagina, for the relief of which a plastic operation might be

made by the usual method. Accordingly, a careful dissection was made upward between the bladder and rectum, but not a trace of vaginal wall could be found at any point. The uterus was finally reached, but no cervix could be made out. The cervix seemed to have sloughed away with the vagina. Douglas's cul-de-sac was opened, and through this the lower segment of the womb could be quite thoroughly outlined. The opening which had thus been made was carefully packed with iodoform gauze, and the patient sent to her room, with the expectation that forty-eight hours later a second operation might be made for the maintenance of the new canal. She absolutely refused,

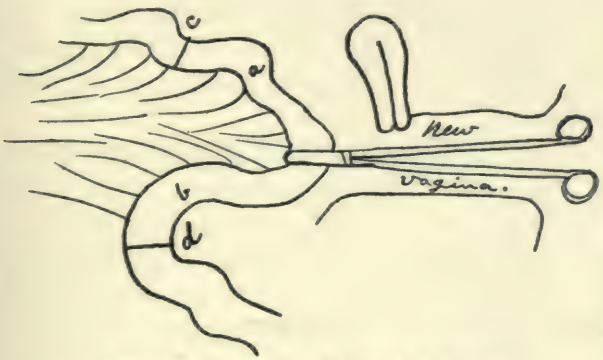


FIG. 1.—*a*, *b*, Sigmoid; *c*, *d*, points for section.

however, to have anything more done (especially as another physician at this stage had volunteered to maintain the patency of the canal by the introduction of a glass plug), and passed from observation.

The method which I had planned to carry out in this case was to utilize for the lining of the new vagina the sigmoid flexure of the colon, or a loop from the lower end of the ileum. The abdomen was to be opened and the sigmoid seized at about its centre by a pair of forceps introduced from below through the new canal and drawn down to the perineum. The length of bowel thus drawn down was next to be detached, with the usual precautions, by a transverse incision through the gut, but without injuring the vessels in the mesocolon, the continuity of

the colon being at once restored by an anastomosis. One end of the vaginal loop would then be inverted and closed by a continuous suture, not penetrating the mucous membrane. By pulling up the fundus of the uterus until the cervix was exposed in Douglas's cul-de-sac (or, if the cervix were absent, the opening into the uterus found), the other end of the bowel would be attached around the cervix by interrupted sutures so as to form a canal for the uterine discharges. The abdomen would then be closed in the usual way, with, if desirable, a drainage wick introduced from above downward through the new canal and just below the loop of intestine. Finally, the patient being placed in the lithotomy position, the loop of bowel still held by the forceps would be opened, the bowel cleansed as necessary, each limb of the loop packed with iodoform gauze, and the edges of the opening in the bowel attached to the surrounding skin.

At the completion of the operation we would have a double vagina, each canal being approximately of the size of the colon, and with the nutrition positively provided for by the integrity of the mesocolon. The gauze would be removed and replaced from time to time as necessary, and at the end of ten days or two weeks the septum between the vaginas could be easily removed by clamp pressure.

Such a vagina would be of ample size, would be lined with normal mucous membrane, would not materially contract, and would serve every purpose save that of child-birth; and it would hardly be prudent perhaps to absolutely deny the possibility of a birth through such a canal, considering the ample capacity of the colon under certain circumstances.

Since having this proposition in mind, I have taken pains in a large number of abdominal operations to notice the amount of available slack in the sigmoid flexure and ileum, and have in all cases found that this would be ample for the purpose suggested. In one instance, through an opportunity offered at a penal institution, I was able to carry out this proposition on the body of an adult male a few minutes after death and while the parts were still in practically a living condition. In this case,

after utilizing the colon and finding it to meet every indication, I drew down the lower end of the ileum and found that to be equally available.

We are all familiar with Ruthkowski's suggestion to utilize the sigmoid flexure in the construction or repair of the bladder;

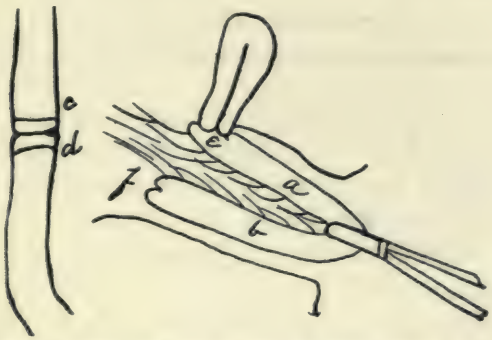


FIG. 2.—*a*, *b*, Sigmoid drawn into new vagina; *c*, *d*, anastomosis; *e*, attachment of one end to cervix; *f*, closed end.

but so far as I can learn a somewhat similar use of the bowel for the construction of a new vagina has not heretofore been suggested. The danger of the operation would be apparently not materially greater than that of an ordinary intestinal anastomosis, and that operation has long since been accepted as an established procedure.

THE USE OF ELECTRICITY IN SKIN-GRAFTING.[1]

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THE use of electricity in skin-grafting in a number of hospital patients has been followed by such gratifying results that the subject has seemed to possess sufficient interest to justify its presentation before this Society. The cases in which the method has been applied were all suffering from chronic ulcers, one or two of them very extensive. In none of the patients has the method been used in fresh wounds accompanied by considerable loss of tissue, as we have here a better method in the use of sliding flaps. If we are careful to check the hæmorrhage, secure a well vascularized flap and bring the parts together with little or no tension in the flap, the healing in almost all cases will be satisfactory. When we desire a better cosmetic effect, as in the face, neck, or other exposed parts of the body, a Thiersch or other transplanted flap will many times give a perfect result; although I think the risks of failure are very much greater than with the sliding flap.

It is, however, in the grafting of old granulating surfaces where the improvement in methods is most needed; for, personally, I confess that with the most careful attention to details I have had many partial successes and not a few complete failures. I suspect that my personal experience has not been unique; and that it would be fair to say that in dealing with a chronic ulcerated surface the results of our efforts to heal them with Reverdin's method has not always been such as to satisfy our earlier expectations.

The other side of the picture is furnished by a quotation

[1] Read before the New York Surgical Society, April 27, 1904.

from Hamilton's "Principles and Practice of Surgery." The following remarks comprise the results of the observations hitherto made and in which nearly all observers concur:

"The more healthy the condition of the granulations the better is the chance of success; indeed, with perfectly healthy granulations success is almost certain. It is not material from what point of the body the graft is taken, although it will be found most convenient to take it from some portion which is thin and flexible. With a pair of mouse-toothed forceps the integument is lifted, and with the knife or scissors cut out. It is generally considered essential that the areolar tissue and fat should not be included in the graft; whether this is a matter of consequence or not I am unable to say; but it is certain that it makes no difference how small the piece may be, and it is not necessary to cut so deep as to draw blood. Having cut out a piece as small as can be conveniently removed, we proceed to divide it into several smaller pieces; nor does the amount of contusion which it suffers in the process seem to affect its vitality. After a trial of several methods of inserting the fragments, I have arrived at the conclusion that if the granulations are fresh and vigorous, there is no better way than simply to lay them upon the surface, without attempting to embed them by incision; nor does it seem to be a matter of any consequence how they lie, whether with the raw surface turned in one direction or the other. The grafts, when several are inserted simultaneously, should be placed at intervals of about one inch apart, as it is observed that the limit of growth of each separate piece does not in general exceed a diameter of one inch or thereabout. In order to retain them in place, I have generally used common adhesive plaster, reinforced by a few turns of the roller. If the operation of grafting is made upon the lower extremities, it will be necessary to impose upon the patient absolute rest in the recumbent position." The dressings are removed after two or three days, the sore cleaned with tepid water and soap, bathed with a weak solution of carbolic acid, and subsequently treated in the usual methods applicable to ordinary ulcers.

These results were secured within three or four years after the introduction of Reverdin's method, long before the days of asepsis; while even antisepsis was still ridiculed by some and half heartily adopted by many; with small grafts cut into still smaller pieces; secured in position by a kind of adhesive plaster then in use, that to some patients proved very irritating, and this plaster was removed in two or three days with the expectation that the grafts laid on and not embedded in the granulations would adhere to the surface of the ulcer instead of the plaster. And yet "with perfectly healthy granulations success was almost certain."

In a paper entitled "Recent Researches in Radio-activity and Electricity: Their Bearing on Radiotherapy; Legal status," read at the New York State Medical Society meeting, January 27, 1904, by J. Sherman Wight, one of the assistant surgeons to the Long Island College Hospital, the author draws attention to the value of electricity in skin-grafting. The method of application and the probable explanation of its action are shown in the following extract from the paper:

"I have been able to show that high frequency discharges will clot blood, acting as a hæmostat, and will coagulate serum albumen; but this is in some degree due to the formation of nitric acid from the air; but there is no destruction of tissue with ordinary care. I have made use of this in sealing surfaces after the removal of several diseased areas, especially in the neighborhood of bone and in fixing grafts to granulating surfaces, the results of which have been so uniformly successful in my experience that I now ask attention to the technique of this method of electric grafting. Render the granulating surface sterile; prepare it to receive the grafts by curetting it thoroughly; and, while it is still oozing, place the grafts of any form desired in position on the surface and bathed in blood; apply the high frequency discharge from a pointed electrode at about one-quarter inch distance over the entire surface till clotting is firm and the grafts are fixed in a dry surface. Serum that is squeezed out in the process of clotting should be sponged off. The dressing consists of three per

cent. carbolized vaseline and plain sterile gauze. It is renewed at the end of the third day. The repair follows in the usual way, but takes a shorter course. Repair was hastened in some cases in which the secondary Röntgen rays were used at the end of the first week.

The following cases were subjected to this method of grafting:

Case I.—A. N., aged forty-two years, liquor dealer, eighteen months ago was operated on for varicose veins of the left leg, and the ulcer on the leg healed in the course of ten weeks. The ulcer reopened in two months, attaining the size of a silver dollar, and was treated, with some improvement, to October 26, 1903. It was then given a three days' preparation with soap, water, and dilute carbolic acid. Reverdin grafts were taken from the thigh and applied by the electric method. At the end of a week the healing surface was exposed to the secondary Röntgen rays for ten minutes. This was repeated at intervals of three days. Repair was complete in three weeks and has remained so.

Case II.—Mrs. T., aged thirty-six years, recovered from a cellulitis of the right leg with an ulcerating surface extending from the outer malleolus three and one-half inches, down on the dorsum of the foot, and two inches in width. I grafted the surface with Thiersch grafts by the electric method, November 24, 1903. The secondary rays were not used till the beginning of the second week, and only repeated twice, fifteen minutes at a sitting. Repair was complete by December 29, 1903. I have not seen her since.

Case III.—W. B., aged forty years, mate of a steamship, was admitted to the service of Dr. Bristow at the Long Island College Hospital, Brooklyn, October 11, 1903, suffering with ulcers of both legs, covering the front of the legs and extending around to the calves from the knee to the ankle. The small superficial veins were injected, and the ulcers had increased in severity for the past five months. I saw him on November 27, 1903. There was a high degree of inflammation of both legs. I had them scrubbed with soap and water and washed with alcohol. The same day I grafted the surfaces of the ulcers of the left leg with both Reverdin and Thiersch grafts by the electric method. The next day I grafted the right leg. The dressings were not removed

till December 2, when the secondary Röntgen rays were applied for ten minutes. The legs were not again exposed to the secondary rays. December 23, 1903, the right leg was healed, and January 11, 1904, he was discharged from the hospital with repair complete in both legs.

Case IV.—O. A., aged twenty-nine years, housewife. Varicose ulcer of right leg just below the patella for four months. She was admitted to the service of Dr. Bristow at the Long Island College Hospital, December 11, 1903. December 12, 1903, ulcer was curetted and bone drilled under general anæsthesia. December 22, 1903, the case was referred to me, and I grafted a surface two and one-half inches in diameter with Thiersch grafts by the electric method. The wound was dressed every third day till she left the hospital, January 3, 1904. She has since come to my office every week and had the healing surface exposed to the secondary Röntgen rays for fifteen minutes. January 25, 1904, the surface was not fully repaired; it measured one-eighth inch in diameter.

Case V.—E. S. B., aged seventy-three years, first noticed a growth on the tragus of the right ear, January, 1903. It grew larger to about the size of a small almond until August, 1903, when it broke down. It was still discharging, December 29, 1903, when I saw him. I froze the surface with ethyl chlorid, cut off the growth with a pair of scissors, and curetted its base. The high frequency discharge was applied till the surface was dry and a dry dressing put in place. January 4, 1904, the surface was again exposed to the high frequency discharge to fix a small graft in place. January 7, primary Röntgen rays were used for ten minutes. January 12, removal of the dressing started some oozing, and the high frequency discharge was again used. January 18, 20, and 23, the secondary Röntgen rays were used for fifteen minutes, and at the last visit repair was complete, leaving almost no scar. Microscopic examination of the specimen in this case showed the growth to be epithelioma. I shall endeavor to keep the patient under observation for recurrence of the growth.

Case VI.—K. McQ., aged sixty years, housewife. Admitted to the hospital November 17, 1903, suffering with a carbuncle at the back of the neck. Deep incisions were made November 18, 1903. December 19, 1903, the granulating surface, three by two and one-half inches in extent, was grafted by the electric method.

No secondary Röntgen rays were used in this case, and January 25, 1904, there is still a surface of one inch by one-half inch left to heal.

I am able to add one more case to the above list.

Case VII.—Male, aged twenty-five years, entered Long Island College Hospital January 4, 1904, with a large ulcer, eight inches long in lower part of right leg, completely encircling the leg except for a strip of skin one inch wide at the back of the leg. The ulcer was the result of a kick of a horse, and had existed eight months; the borders inflamed; over the fibula was a fusiform mass about three inches long and a half-inch thick, which was suspected to be malignant, but which proved to be inflammatory. After about four weeks' treatment to secure a healthy granulating surface, ten grafts from the sterilized skin of the thigh were placed in the surface and the usual protective dressing applied. This attempt failed. About two weeks after this, Dr. Wight, to whom I referred the case, with the surface apparently in the same condition as when I made my attempt, succeeded in having twenty-eight out of thirty-two grafts hold fast and grow secured in position by the electric methods. The Röntgen has been applied twice. The surface now is healing, but slowly.

A study of these seven cases, which are perhaps as instructive as a larger number, and an opportunity to see the application of the electricity, convinces me that we have in this method of grafting a pretty certain way of fixing the grafts, and I doubt if anything more can be claimed for it. It certainly coagulates the blood and secures the graft in its new position. I doubt the benefit of the secondary application of the Röntgen rays, and whether the healing process goes on any more rapidly than in any other way after fixation of the graft. Of course, the resultant scar is the same as in other methods. Why it is that 12½ per cent. of the grafts did not adhere and grow in the last case reported would be as difficult to answer as why the other 87½ per cent. did. Our knowledge of the causes of success will doubtless explain the causes of failure. While successful grafting by Reverdin's method depends on having a surface as healthy as possible, the granulating surface is never perfectly healthy, as pus is never laudable. It is always in-

fected, and so possibly infective to the grafts; it is quite impossible to sterilize the sore and have it in as favorable condition for grafting as in freshly made surfaces. Successful grafting does not depend entirely, if at all, in vascularization of the graft as proved by the experience of Lusk, who used successfully the epidermic layer from a blister sterilized and kept 418 days before being used as grafts. Nor does the word "epidermization" express exactly what takes place, for Howard used bits of muscle successfully; again, the resulting scar has not the structure of skin, but is like all scar tissue made up of connective tissue free from hair-follicles, sweat, and sebaceous glands, and unfortunately the resulting scar is very prone to break down under very slight injury.

In conclusion, I may state that, in our attempts at healing old granulating surfaces with small grafts, we have in the use of the electric method a more exact and successful way than any heretofore employed, by fixing the grafts on the granulating surface.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting, April 27, 1904.

CHARLES L. GIBSON, M.D., in the Chair.

EXCISION OF RECTUM FOR CARCINOMA.

DR. WILLY MEYER presented a man, forty-eight years old, who, when he first came under observation in the summer of 1903, showed all the symptoms of a neoplasm of the rectum. The rectoscope showed a new growth about five inches above the anus; this bled easily, and was typical in appearance of carcinoma.

An operation was proposed, but declined by the patient. He returned some months later, much emaciated; his symptoms were aggravated and the local condition more pronounced. A day was set for the operation, but before its arrival the patient suddenly had an attack of acute intestinal obstruction, with stercoraceous vomiting, and in order to relieve this inguinal colostomy was hurriedly done.

A subsequent examination of the malignant growth in the rectum showed that it was immovable and firmly adherent to the sacrum. This condition usually rendered the outlook of a radical operation unfavorable; but, as the patient and his family were insistent, Dr. Meyer operated by the Kraske method on November 6, 1903. The operation was done in the knee-chest posture, which the speaker said he favored in these cases. After laying open the parts widely, and opening the peritoneum, the growth could be pulled down into view. It could not be brought down far enough, however, to do a resection, and Dr. Meyer thereupon decided to

excise the entire lower rectum and make a sacral anus. He was strongly tempted to close the lower end of the divided gut, leaving it as a blind pouch, and allowing the patient to continue to empty his bowels through the old colostomy wound; but he was restrained from doing this by the presence of a number of hard masses that could be felt above the cut end of the intestine.

Subsequent to the operation, the patient complained of intense pain in the lower bowel. This was so severe that it could not be overcome by even large doses of morphine, and when Dr. Meyer again saw the patient, about twenty hours after the operation, he found that the pain was due to the fact that the sacral anus had become occluded by a large fæcal stone. This, with three or four of the same kind appearing later, had to be removed with instruments. Subsequent recovery was uneventful. To-day the patient has, in addition to the sacral anus, his inguinal colostomy wound, which he is anxious to have closed. Dr. Meyer said he would keep the patient under observation, and if, at the end of a year, the outlook was still favorable he would close the colostomy wound and leave the sacral anus.

In reply to a question as to why the knee-chest posture was preferred at the German Hospital in operating on these cases, Dr. Meyer said it had been introduced there by Dr. Lange, and possessed such manifest advantages over the Sims's position that it had been generally resorted to since. The abdomen was supported by a box-like apparatus, while the upper part of the body rested on the pillows. This gave a very good access to the parts. Hæmorrhage is also much lessened. One possible objection to it was that in cases where the rectum had been accidentally opened or torn, the danger of infection was increased by the gravitation of the intestines towards the diaphragm.

CHRONIC CHOLANGEITIS; CHOLEDOCHOTOMY.

Dr. Willy Meyer presented a woman, fifty-four years old, who entered the German Hospital early in October, 1903. She complained of frequent chills, and had been deeply jaundiced for three months. The stools were clay-colored. The patient was very stout, and had a large irreducible ventral hernia.

Operation, October 15, 1903. On account of the pendulous abdomen, the primary incision through the rectus had to be lengthened in the shape of Kehr's "Wellenschnitt." The fundus

of the gall-bladder was found to be covered with omentum. A stone could be felt in the bladder, and could be traced into a distended viscus which seemed to be the lower half of an hour-glass-shaped gall-bladder. Upon aspiration, yellow, non-smelling gall escaped. The fundus was incised and three stones removed. The finger was then passed from the upper strictured section of the gall-bladder into a lower, larger compartment, which extended so far down behind the duodenum that it was at once recognized as the common duct distended to about the size of a large thumb. Two more calculi were found in the strictured portion of the bladder, and, finally, a round stone, evidently situated in the distended papilla. After the removal of these calculi, a sound was easily passed into the duodenum. Palpation of the hepatic duct revealed another faceted stone at its bifurcation.

The hepatic duct was drained and the common duct closed. On account of the poor condition of the patient, the shrunken gall-bladder was left behind after it had been split, its mucosa cauterized, and one part fastened to the abdominal wall. The patient made an uneventful recovery, and had since enjoyed good health.

Dr. Gibson said that all the biliary calculi in Dr. Meyer's case were doubtless from the same source. Yet the assertion had been made that stones that were formed in the biliary duct were of a different make-up from those in the gall-bladder. Biliary duct calculi were not supposed to give rise to serious obstruction; that is, they never reached that size.

EXOSTOSIS BURSATA OF FEMUR.

Dr. Willy Meyer presented a man, twenty-five years of age, who came under his observation with the diagnosis of osteosarcoma of the thigh. Examination showed a hard mass on the inner side of the left femur. It was soft in parts, and on palpation gave a parchment-like feeling. The patient insisted that the swelling had not existed over three months. The tumor was evidently above the epiphysis, and was irregular in contour. Dr. Meyer said he was inclined to regard it as an exostosis bursata of the femur. This diagnosis was practically confirmed by the X-ray, which showed that the shaft of the bone was normal, and that the growth consisted of an irregular mass, with a pedicle connecting it with the femur.

An incision was made over the mass, which was filled with

fluid and clotted blood. Its pedicle, attached to the femur, was easily chiselled off.

Dr. Meyer said the growth had probably existed longer than the time stated by the patient. Recovery was uneventful, and with perfect use of the leg.

SEVERE LACERATION OF THE ABDOMINAL WALL.

Dr. Charles H. Peck presented a man, thirty-four years of age, who was admitted to Roosevelt Hospital on March 23, 1904, in the service of Dr. Robert F. Weir. About an hour previous to his admission, while working in front of an anvil in an automobile repair shop, an automobile was accidentally started, striking him in the back with great force, and shoving his abdomen against the point of the anvil. He immediately felt very faint, but did not lose consciousness, and was brought to the hospital without delay in an automobile.

On admission, the patient was in moderate shock. Over the left, lower quadrant of the abdomen there was a soft mass, apparently consisting of coils of intestine lying just beneath the skin. Peristaltic movements could be seen and felt. The mass was tympanitic on percussion and could not be easily reduced. The abdominal walls were soft; there was no rigidity. Evidences of contusion of the skin extended as low as Poupart's ligament and the saphenous opening, but there was no wound nor tear of the skin. Pulsation was absent in the left femoral, popliteal, and posterior tibial arteries, but the leg was warm.

Operation, under ether, two and one-half hours after receipt of the injury. A six-inch oblique incision was made midway between the umbilicus and the iliac spine. Immediately underneath the skin, which was avulsed over the entire left lower quadrant of the abdomen from the level of the umbilicus to Poupart's ligament, lay a mass consisting of coils of undistended intestine. There was a complete transverse tear of the entire structure of the abdominal wall beneath the skin, including the peritoneum, from the inner third of the right rectus muscle to the left, to about the anterior-axillary line, the torn structures being the inner third of the right rectus, with its sheath, the linea alba, the entire left rectus and sheath, the external and internal oblique and transversalis, with the peritoneum for a corresponding distance. There was no injury to the intestines or other viscera.

There was a hæmatoma in the left iliac fossa, with a small tear in the retroperitoneum near the pelvic brim.

The posterior peritoneum was incised over the hæmatoma and the common and external iliac arteries exposed; pulsation was normal in the common and internal iliac arteries, much diminished at the commencement of the external iliac, and absent at the level of Poupart's ligament. No injury of the external coat of the artery could be made out; the veins were uninjured. There was a complete transverse rupture of the left psoas muscle, with a separation of its ends of from one and one-half to two inches; the left ureter and the anterior crural nerve lay exposed in the gap, but were uninjured.

No attempt was made to suture the psoas muscle. The posterior peritoneum was sutured and a cigarette drain placed extraperitoneally in the depth of the wound. The anterior peritoneum was then sutured with plain catgut; then the muscles and fascia, layer by layer, with No. 2 chromic gut; the skin was closed with silkworm gut and silk and a dry sterile dressing applied.

The patient made an uninterrupted recovery. The drain was removed on the third day and not replaced. The skin sutures were removed on the seventh day. The wound healed by primary union; the patient was allowed to sit up on the twenty-fifth day, and was discharged, cured, two days later. Pulsation returned in the femoral and posterior tibial arteries about a week after the operation. The limb was never cold nor cyanosed.

Dr. Hartwell, in discussing the possibility of a traumatic aneurism occurring in this case, on account of the contusion to the intima of the external iliac artery, said that last summer he made a number of experiments on animals, and the results were of some interest as bearing on this subject. A needle was inserted through the coats of the artery, and its inner wall scratched with the point of the instrument. The artery was then suspended and subjected to pressure from the inside by a fluid column; and it was demonstrated that a vessel thus irritated would become dilated with a much less pressure than one that had not been subjected to injury.

RETROPERITONEAL ABSCESS.

Dr. John A. Hartwell presented a colored boy, eighteen years old, who was admitted to the Lincoln Hospital on the 21st

of February, 1904. His family history was unimportant. The patient had had varicella in childhood, and five years ago, while living in Virginia, he had what was called "bilious intermittent fever," which lasted about three weeks. Last summer he had measles, and was ill for two weeks. Every winter he gets a "cold," accompanied by cough and mucopurulent expectoration. These attacks usualy last several weeks, and then pass off. His appetite had always been good, but since last September there had been a gradual loss of endurance, although he had not noticed any loss in weight. His bowels had always been regular and he voided his urine normally. He rarely indulged in alcoholic stimulants; he was never injured; denied gonorrhœa and syphilis.

Four months ago the patient was suddenly seized with a sharp, cramp-like pain in the lower abdomen. Its point of greatest intensity was the umbilicus, and it did not radiate. The attack came on without apparent cause and was not accompanied by vomiting, constipation, diarrhœa, or other symptoms, but he thought his abdomen was slightly swollen at the time. The pain persisted about twelve hours, and after its disappearance the belly remained tender for three days. A similar attack occurred about six weeks later; this was milder than the first, lasting only about eight hours, and the belly remaining tender for about two days afterwards. The attack was relieved by taking a Seidlitz powder. No physician was called during either attack.

The patient remained perfectly well until February 17 of the present year, when he was again suddenly taken with a cramp-like, sharp pain in the lower abdomen, most marked over the umbilicus. This time the pain radiated into the left groin and the upper, anterior surface of the left thigh. He passed his urine with difficulty, and had a sharp pain in the posterior urethra on voiding. Four days later, when he was brought to the hospital, he said his bowels had not moved since the beginning of the attack. He was given a soap-suds enema, but with poor results.

Upon admission, the patient complained of pain in the lower abdomen. There was marked abdominal distention; there was considerable muscular rigidity, marked tenderness, and dulness from the left flank towards the umbilicus. Upon examination per rectum, the seminal vesicles were found to be greatly enlarged and exceedingly soft and tender. The patient's temperature was 102° F.; leucocyte count, 12,000; urine, normal. The case was regarded as one of probable tubercular peritonitis.

Operation, February 26, 1904. Under the influence of the anæsthetic, the abdominal muscles became relaxed; and, as the seat of the trouble seemed to be on the left side, where a distinct mass could now be felt, an incision was made over it. Upon exposing the peritoneum, a large retroperitoneal abscess cavity was revealed, which contained about fourteen ounces of thin, whitish pus. The abscess cavity could be followed down behind the sigmoid, and apparently communicated with the enlarged seminal vesicles below.

The wound was drained for a few days, and closed entirely in two weeks. The patient left the hospital, entirely well, less than three weeks after the operation. Six days after the operation, a rectal examination showed that the enlarged seminal vesicles had greatly decreased in size, and before the patient was discharged they were absolutely normal.

Dr. Hartwell said he did not know what, if any, relation the enlarged seminal vesicles had to the retroperitoneal abscess in this case, nor did he know the source of infection. The original theory that it was tubercular was probably wrong, from the fact that the wound healed so promptly and without a resulting sinus.

ACUTE TETANUS TREATED BY MEANS OF INTRANEURAL AND SPINAL INJECTIONS OF ANTITOXIN.

Dr. John Rogers said that about two years ago certain experiments were carried out in the Pasteur Institute in Paris to illustrate the action of the tetanus poison. These experiments went to show that this particular poison exerted all its effects on the ganglia in the spinal cord. They also demonstrated that it could only reach the spinal cord through the motor nerves, and that its progress in these nerves depended on the integrity of the axis-cylinders.

Further experiments along this line demonstrated that the tetanus toxins could only reach the spinal cord through the motor nerves, and that in animals a fatal inoculation of the poison into one of the extremities could be checked by intraneural injections of tetanus antitoxin. It was shown that the poison could only travel centripetally in the motor nerves, and that it could not travel at all through the sensory nerves. It was also shown that if the poison was introduced directly into the spinal cord, tetanus

occurred within a few hours. Its only mode of entrance into the motor nerves was through the muscle-end apparatus.

The patient shown by Dr. Rogers was a boy, twelve years old, who on the 17th of March, 1904, received a shot-wound of the hand. The injury, which was inflicted by a toy pistol, was treated in some hospital, where a wet dressing was applied. Five days later his family physician removed a piece of gun-wad from the wound.

On April 1, about sixteen days after the receipt of the injury, the boy began to experience some difficulty in chewing. On the following day this difficulty increased, and his walk became peculiar. On Sunday, April 3, two days after the onset of his symptoms, he had a severe convulsion and complained of cramp-like pains. When Dr. Rogers saw the patient that night, the body was perfectly rigid; there was marked opisthotonus and every sign of acute tetanus. He immediately exposed the left brachial plexus, isolated each one of the nerves, and injected into each about five or ten minims of tetanus antitoxin. Altogether, about twenty minims were injected into these nerves. In addition to this, sixty minims were injected directly into the spinal cord.

The following morning the patient's muscles were somewhat relaxed, so that he was able to roll about in bed. His jaw, however, was still somewhat rigid, and it was decided to repeat the treatment. The wound in the axilla was reopened and an injection was made into one of the nerves of the brachial plexus, followed by a spinal injection.

On the following day, the rigidity of the muscles had entirely disappeared, and, with the exception of extreme weakness, the patient was very comfortable. From that time on he made an uninterrupted recovery.

Dr. Willy Meyer asked Dr. Rogers whether he thought the same good results would have been obtained by injecting the antitoxin into the subarachnoid space only, instead of into the spinal cord and brachial nerves; and if it made a difference whether the antitoxin travelled over the same route as the poison or not? The speaker recalled one case where recovery followed the injection of the antitoxin into the cord only, although others had reported failures after the same method.

Dr. Rogers said that, in making the spinal injections, it was important to scratch the cord or one or more of the nerve filaments



F. Tilden Brown's case of benign gastric ulcer (posterior wall). Drawing presents the peritoneal aspect of the tissues and ulcer excised.

with the point of the needle, so that the antitoxin would enter the cord. Simple injection into the subarachnoid space without making any abrasion of the cord itself was of no more value than if it were injected subcutaneously. Injecting it into the ventricle of the brain was absolutely valueless, as the experiments mentioned before proved that the toxin could not diffuse downward, and all the facts known seem to show that the antitoxin follows the same paths.

In reply to a question as to whether his patient had received any treatment in addition to the injections of antitoxin, Dr. Rogers said he had been given sixty grains of bromide of sodium and thirty grains of chloral, in divided doses, on the second day of the disease. The delay in the onset of the acute symptoms in this case was probably due to the site of the inoculation of the poison.

Dr. Rogers said that while the inoculations into the brachial nerves might have been sufficient, he did not feel confident enough of that fact to omit the injections into the spinal cord. In cases where he injected the spinal cord only, the patients had died.

THE USE OF ELECTRICITY IN SKIN-GRAFTING.

Dr. John D. Rushmore read a paper with the above title, for which see page 404.

A POSTERIOR WALL GASTRIC ULCER.

Dr. F. Tilden Brown said that, by the courtesy of Dr. F. H. Markoe, he had the opportunity to show an autopsy specimen revealing what followed an operation of his own done three years previously, at Trinity Hospital, for a perforating gastric ulcer. Six weeks after the operation the patient appeared to be well, and he was presented before the Society at its February meeting in 1899. Gradually gastric symptoms recurred and on September 28, 1902, he entered the New York Hospital with symptoms of pyloric obstruction, for which a gastrojejunostomy was done. He died five days later. At autopsy the site of the original gastric ulcer showed much nearer the pylorus than was expected, and the intestine originally found adherent to the margin of and occluding the ulcer was pretty certainly the transverse portion of the duodenum.

At the speaker's operation, an incision between ensiform and umbilicus revealed a mass behind the stomach. Access was had

to it through the gastrocolic omentum. The stomach was drawn out and turned upward after separating the adherent duodenum, when a one and a quarter inch by three-quarters inch ulcer was exposed on its posterior wall. Surrounding induration required excision of tissue, shown in the drawing. The muscular coats were approximated with two layers of chromic gut suture and the serous coat with two of silk. Then a strip of sterile gauze was laid over the suturing and the stomach turned back. This aim to provide for existing or subsequent soiling was an error, and probably explains both the considerable diverticulum seen in the specimen, and which in time led to the necessity for a second operation. For after the first this strip of gauze was gotten out only after very considerable traction made at each subsequent dressing, and in its semicircular wrapping of the stomach it is quite probable that the gradual traction tore apart the gastric wound; but immediate agglutinating contact of the left lobe of the liver and pancreas prevented escape of gastric contents, and the excavations in these viscera, as is now shown in the specimen, continued to act as the limiting walls of a constantly increasing cul-de-sac which in turn exerted sufficient pressure upon the pylorus as to all but occlude it.

That part of the post-mortem notes of most interest is as follows: Firstly, in connection with the last operation under the caption, "Intestines." At a point seventy-three centimetres from its origin, the jejunum is attached to the posterior wall of the pyloric end of the stomach, and communication between the two is established by means of a Murphy button. There is no leakage at the point of anastomosis. The loop of jejunum between origin and point of anastomosis hangs downward a distance of about fifteen centimetres into the left iliac region. It is hyperæmic and distended with fluid of fæces to a diameter of five centimetres.

Stomach. The stomach is not apparently enlarged; its measurements are thirty-three centimetres along the greater curvature and ten centimetres along the lesser curvature. Corresponding to the adhesion of the left lobe of the liver to the stomach there is a large, old ulcer just a little to the left of the pylorus. It measures one and one-fourth by two centimetres in the long axis of the stomach and five centimetres in the opposite direction. The edge of the ulcer is but slightly indurated, deeply undermined and rounded, quite smooth, and appears to have a covering of mucous

membrane. The entire thickness of the stomach is destroyed over the whole ulcerated area. The base of the ulcer being formed by dense fibrous tissue which is firmly attached to the pancreas and left lobe of the liver. The cavity resulting from this ulceration measures 7 x 3 x 2 centimetres. The ulcer involves the lesser curvature and a little more of the posterior than of the anterior wall. The long measurement being at right angles to the long axis of the stomach. The posterior wall of the pylorus is thickened to the extent of one centimetre, and forms part of the wall of the ulcer. The pyloric orifice appears as a vertical slit-like opening which can be forcibly enlarged, but under natural conditions would probably interfere materially with the passage of food. The inferior portion of the pyloric end of the stomach pouches to the right of the pylorus about two and one-half centimetres (and it is into this pouch that the anastomosis was made), a little below and to the right of the pylorus.

Microscopic examination. The thickening of the pylorus is due to an abundance of racemose gland tissue and increase of fibrous tissue in submucous and muscular layers. Mucous membrane at the edge of ulcer is inflamed, but there is no evidence of malignancy.

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting, May 2, 1904.

The President, HENRY R. WHARTON, M.D., in the Chair.

MULTIPLE NEUROMATA OF THE ARM.

DR. JAMES K. YOUNG exhibited a man of sixty-four years who has always enjoyed good health. Thirty years ago a subcutaneous nodule appeared in the bend of the left elbow over the line of a nerve-trunk. A second one appeared later in the axilla, and then others on the inner and outer aspects of the arm. There are now nine large and several small tumors, the last of which appeared one year ago. (Fig. 1.) They are exceedingly painful, but Dr. Young is inclined to regard them as pseudoneuromata that can be shelled out by operation. The case is a rare one because the new growths are confined to the one extremity and to the distribution of a single nerve.

DR. FRANCIS T. STEWART has operated upon a similar case within the past month. Seventeen tumors were removed from the flexor surface of the arm and forearm. One pathologist pronounced them to be fibromata, and a second reported them as leiomyomata. Clinically they presented the characteristics of fibromata. Some of them were connected with nerves, but the majority were not so related.

DR. WILLIAM J. TAYLOR mentioned the case of a woman upon whom he had operated five times in thirteen years, removing in all thirty-two neuromata from the internal plantar and posterior tibial nerves. In size the tumors varied from that of a small pea to a large filbert. The condition of the foot was so peculiar and pain from pressure so severe that the patient had been known to fall from a chair when a finger-nail was drawn over the tumors; at



FIG. 1.—Multiple neuromata of arm.

such times large drops of sweat would exude from the skin of the foot. No relief followed repeated removal of the tumors, and finally eight inches of the internal plantar and posterior tibial nerves were removed. Since that the patient has been perfectly well. A careful examination of the tumors by Dr. Spiller showed them to be neuromata. The symptoms in Dr. Young's patient are so different, that Dr. Taylor is inclined to regard the growths as fibromata rather than neuromata.

FRACTURE OF THE LOWER EXTREMITY OF THE RADIUS, WITH ANTERIOR DISPLACEMENT OF THE LOWER FRAGMENT.

Dr. Francis T. Stewart showed two skiagrams of fracture of the lower end of the radius in which the lower fragment was displaced to the palmar side. The patient was a man of fifty years, who had received a blow from a heavy weapon upon the back of the wrist. He thought the injury was only a contusion, and treated it for several days with local application before appearing at the hospital. The injury was treated on a Bond splint.

Dr. John B. Roberts mentioned two recent cases in which the fracture was the same as that described by Dr. Stewart. The first was that of a lady who was thrown from a horse and struck on the back of her hand in such a manner as to drive forward the lower fragment of the fractured radius. Six years ago he saw a similar condition in a man, but does not recall the manner in which the injury was received. The fracture in neither instance had been recognized by the attending physician. Dr. Roberts believes that this fracture is usually not recognized, although it seems there should be no difficulty in the diagnosis. He illustrated by diagrams an easily recognized point in diagnosis which simply depends upon the character of the deformity. As compared with a true Colles's fracture, the deformity is more like that of a gardener's spade than that of a silver fork. This fracture should not be called a Colles's fracture, as that name implies a posterior displacement of the lower fragment of the radius. It has been called a Smith's fracture and a reversed Colles's fracture. He showed a number of casts, photographs, and skiagraphs, as well as two specimens from the Mütter Museum, illustrating this injury.

MOYNIHAN'S CLAMP AND SPLIT-EYED NEEDLES FOR USE IN GASTRO-ENTEROSTOMY.

Dr. William J. Taylor, for Dr. W. W. Keen, showed these instruments. Dr. Taylor in this connection stated that some time since, when desiring to use similar needles, he took split-eyed or calyx-eyed needles, took out the temper, bent them to the desired shape, and retempered them. He found them very satisfactory, in a certain sense answering his purpose better than those of Moynihan.

RUPTURE OF GALL-BLADDER, WITH PROFOUND TOXÆMIA.

Dr. John H. Jopson reported a case of cholelithiasis with rupture of the gall-bladder and extensive peritonitis in a woman of fifty-one years, and the development, after operation, of a peculiar form of toxæmia, with delirium. There was a history of acute cholecystitis seven years before, and of attacks of gall-stone colic somewhat over a year ago, with persisting impairment of health and strength, pain, and indigestion. Preceding rupture, there was an attack of very severe colic lasting over two days, and followed by symptoms of general peritonitis and collapse, with fever and leucocytosis. Operation, seventy-two hours after the onset of colic, revealed a large quantity of bile in the abdominal cavity, and extensive peritonitis, many fresh adhesions, and pockets of bile and mucus as far down as the pelvis. The exact site of perforation in the collapsed gall-bladder was not located. There was an oval stone the size of a date-seed in the first portion of the cystic duct. After drainage of the gall-bladder and peritoneal cavity there was prompt improvement in the local and constitutional condition, and a gradual fall in the leucocyte count, with rapid disappearance of the slight jaundice present before operation. There was no obstruction of the common duct. Immediately after operation the urine contained a moderate amount of albumen, and many casts and some bile were secreted in good amount, and the abnormal constituents gradually disappeared. The pulse remained rapid for ten days. Nine days after operation, the patient became delirious. Her mental condition and general appearance closely resembled those sometimes observed in alcoholic subjects after accident or operation, although there was

no alcoholic history. The face was flushed, the tongue coated, the mind wandering, with hallucinations and delusions. She was very restless at all times, but especially at night, when she was restive and abusive, and required constant watching and restraint to keep her from removing her dressings and from getting out of bed. There was no tremor. The temperature remained at or near the normal line, except for a slight evening rise for a few days, due to slight infection of the pelvic sinus and a stitch abscess. There was free drainage of bile from the gall-bladder. The mental symptoms lasted for a week, at the end of which time they passed off rather quickly. The drainage was removed from the gall-bladder after two weeks. Its removal was followed by a rise of temperature, irregular fever, and occasional chills; it was reintroduced ten days later, and retained for a week, when it was permanently removed, the convalescence being thereafter uninterrupted.

RUPTURE OF THE GALL-BLADDER, WITH GALL-STONES, AND AN ABSCESS PRODUCING PROFOUND TOXÆMIA.

Dr. William J. Taylor reported the case of a married woman aged sixty-four, who had always been well and strong, and who gave no history of fevers, digestive disturbances, nor previous abdominal pain. One sister died at about the same age of what was said to be gall-stones, although there had been no operation to determine this, nor post-mortem examination made. Four weeks before her admission to the hospital, the patient was suddenly seized with pain in the region of the liver and gall-bladder, which was extremely severe in type, and continued with but slight intermissions. She had never been jaundiced, nor especially constipated, and beyond abdominal pain, tenderness, and some fever, there had been no marked symptoms. Her temperature when first seen was 102° F.; there was some rigidity of the right rectus muscle and no abdominal distention, although the belly was full. There was great tenderness, and an indistinct mass over the region of the liver and gall-bladder; the tenderness extending down into the iliac fossa. Her pulse was 80, her tongue fairly clean, and there had been no vomiting. The next day, as her local conditions had not improved materially under fractional doses of calomel, although her temperature had

fallen to the normal, he operated. The liver was much enlarged and covered with lymph. Quite a large quantity of thin, but glairy, yellowish-green pus to the amount of five or six ounces welled out as soon as the peritoneum was opened. There was an immense number of adhesions, and at the edge of the liver over the region of the gall-bladder an abscess was found. There were so many adhesions, that it was difficult to determine the exact relations of the parts. In what had the appearance of an abscess cavity at the depth of two inches a large gall-stone could be felt. This, after considerable dissection through the adhesions, was taken out, and four or five smaller stones were also removed. The gall-bladder was now seen to be ruptured and completely disorganized. All that remained of the gall-bladder was dissected away, and the wound packed with iodoform gauze; a wick of gauze was also passed down into the pelvis for drainage. She had little or no shock following the operation; her temperature once reached 102° F., then fell to the normal line, and remained so for one week, when it again arose to 100° F. for a few days, and again became normal. Almost immediately from the time of operation she showed evidences of a profound systemic toxæmia, such as he had never seen before. Up to the time of operation there were no evidences of anything but a local disturbance, the tongue was heavily coated, almost black, the mouth dry and parched, and this was so pronounced that she could swallow only with difficulty. She was dull, somnolent, and apathetic, but could be roused to answer questions. Her face was very much flushed, but there was no marked jaundice, although the skin was yellowish. She gave the appearance of one who had been on a protracted alcoholic spree, but she was absolutely temperate in all of her habits, and had never been a drinking woman. There were no abdominal symptoms of moment; she complained of little or no pain, and the whole course of her illness was rather against this condition being produced by an ordinary septic intoxication. The fact that the gall-bladder wall was destroyed might have been a producing factor in this profound toxic state. Certainly the toxæmia was one of a very unusual character, and the symptoms not those usually found in septic infection.

The operation was performed on February 24, 1904, and the wound was entirely closed by April 4, when she left the hospital apparently in perfect health.

(1) RUPTURE OF THE GALL-BLADDER IN ACUTE CHOLECYSTITIS. (2) RUPTURE OF A BILE-DUCT FOLLOWING CHOLECYSTOTOMY WITHOUT DRAINAGE.

Dr. Robert G. Le Conte said that in briefly reporting these two cases, which of themselves are not of any great surgical interest, he did so as an antithesis to the two cases reported by Drs. Jopson and Taylor, in which a certain group of toxic symptoms were present, attributed to the presence of bile in the peritoneal cavity. In the cases he was about to report these toxic symptoms did not appear.

Case I.—L. L., aged thirty-one years, laborer, born in Italy, was admitted to the Pennsylvania Hospital, December 21, 1903, with the diagnosis of acute suppurative appendicitis. Patient had been ill for three days with pain in the right side of the abdomen, rigidity of the right rectus, considerable tenderness, chills, fever, and vomiting. On admission his cheeks were flushed, tongue clean, no jaundice, chest negative, liver dulness increased, extending from the fourth interspace to two inches below the costal margin. Abdomen slightly distended; great tenderness of the upper right quadrant; marked rigidity of the right rectus. No tumor could be outlined in the region of the gall-bladder owing to the tenderness and rigidity. The appendiceal region was negative to examination. *Urine,* slight trace of albumen, hyalin and granular casts, no bile pigment, leucocytes 12,500. Widal reaction slightly suggestive. Temperature varied from 101° to 103° F. Diagnosis, acute suppurative cholecystitis. Operation refused.

Treatment consisted of an ice-cap to the abdomen, milk diet, with the exhibition of small doses of calomel and phosphate of soda. In a week the temperature had dropped to normal, the pain disappeared, but slight tenderness and rigidity persisted. By the end of the second week tenderness and rigidity had also disappeared and the patient seemed to have entirely recovered. He refused to remain longer in the hospital, and was discharged January 7, 1904.

Readmitted January 16, 1904. Abdominal symptoms practically the same as on previous admission, temperature ranging from 102° to 103.5° F.; urine negative; leucocyte count, 10,400.

January 18. Ether was administered and incision made in the right rectus muscle over the gall-bladder. The gall-bladder was found firmly embedded in a mass of adhesions and covered

by the colon. On separating these adhesions a pericystic abscess was found in the region of the neck of the gall-bladder, perforation of that organ having taken place just above the cystic duct. The abscess outside of the gall-bladder contained perhaps one ounce of pus, while the gall-bladder itself was distended with a purulent secretion. After swabbing out this pus, the adhesions about the cystic and common ducts were found so dense that it was thought inadvisable to attempt an exposure of these ducts or to attempt an excision of the gall-bladder. An opening was made in the fundus of the gall-bladder and a rubber tube passed to its lowest point. Another rubber tube was passed to the bottom of the abscess cavity outside of the gall-bladder, and some iodoform gauze wicks were also introduced. Two silkworm-gut sutures partially closed the abdominal wound. Recovery was uneventful. The temperature soon fell to normal; pain disappeared; pus was discharged freely for a week without a trace of bile. At the end of six days the gauze wicks were removed, and at the end of two and one-half weeks the rubber drainage tubes also. At the end of two weeks the purulent discharge had ceased and bile was flowing freely through the drainage tubes. He was discharged with a very small sinus discharging bile on February 19, the rest of the wound having entirely healed.

In reporting the second case, he called attention to the fact that the operation was undertaken five years ago, at a time when the advantages of drainage of the gall-bladder were not perfectly understood, and that the operation performed in this case—the so-called ideal operation—cannot be justified in the light of our knowledge of to-day. He was led to do it at that time on account of having had two cases previously that made uneventful recoveries, in which the pathological lesions were similar to this one.

Case II.—I. G., aged forty-five years, a Russian, was admitted to the medical wards of the Pennsylvania Hospital in August, 1899. He gave a history of cholelithiasis extending over a period of more than six years, with from two to three sharp attacks of colic each year. On admission jaundice was visible in the conjunctivæ and in the skin over the chest and abdomen. Liver dulness was not increased; palpable tumor in the region of the gall-bladder, with tenderness and rigidity of the upper right rectus muscle, but no fever.

Operation, August 18, 1899. Incision through right rectus; universal adhesions about the gall-bladder and ducts; gall-bladder much distended, filled with gravel varying in size from sand to buckshot. Cystic and common ducts also distended with same material. This material was removed, and the gall-bladder and ducts flushed with salt solution; gall-bladder was then closed with catgut sutures and the abdomen closed without drainage. The jaundice disappeared, and the recovery was uneventful. Discharged September 11, 1899.

Readmitted September 18, 1899, one week from the previous discharge, with abdominal pain and tenderness in the epigastric and right hypochondriac regions; much jaundice; vomiting; increasing distention of the abdomen and rigidity of the right side. September 21, as Dr. Le Conte was absent from the city, an incision was made alongside of the old scar by Dr. T. S. K. Morton. On opening the abdomen bile immediately escaped. Many adhesions were present. The gall-bladder was exposed, but no rupture could be found, and the scar at the fundus from previous operation was sound. Owing to the adhesions, the cystic and common ducts were not well exposed, but with such exploration as was made no rupture could be demonstrated. The abdominal cavity was washed out and packed with iodoform gauze. The recovery was uneventful. The amount of bile discharged from the wound grew less and less, and in three weeks had entirely ceased. He was discharged October 18 with a small granulating area in the region of the wound.

In view of the fact that jaundice was marked and that the exposed portions of the gall-bladder, especially the seat of the previous incision, were found sound, he judged that some portion of the common duct had ruptured, owing perhaps to some kinking due to the many and firm adhesions surrounding it.

Dr. Le Conte further remarked that so many cases had been reported where bile was present in the peritoneal cavity without producing profound toxic symptoms, that one must eliminate many other factors before concluding that such toxæmia is caused by the peritoneal absorption of bile. As in appendicitis, such symptoms can readily be produced from the presence of septic material in the bile, or, as in uræmia, from the lack of eliminating powers of the kidney. Again, if no bile is entering the intestine, the possibility of auto-intoxication from intestinal contents would have to be eliminated. To his mind such profound toxæmia is

more likely to have been produced by absorption of purulent products by the peritoneum, which products were perhaps not eliminated by the kidneys. Under such circumstances the presence of bile in the peritoneal cavity would be simply a coincidence and not a causation of the symptoms.

ACUTE CHOLECYSTITIS WITH GALL-STONES IN A GIRL OF SEVENTEEN.

Dr. E. Hollingsworth Siter reported the history of a girl, aged seventeen years, who was admitted to St. Agnes's Hospital, February 10, 1904, with the following history: On February 5 (five days ago) patient was seized with pain, of a severe character, about the umbilicus, followed by vomiting. The pain rapidly spread over the entire abdomen, and in thirty-six hours localized itself over the appendiceal region. Vomiting was not fæcal, but contained bile. There had been no constipation and no jaundice.

Examination of the patient shows her lying on her left side with the right leg flexed. Palpation showed slight rigidity more marked on right side, abdomen was slightly distended and somewhat tympanitic.

An incision was made over the gall-bladder and extending down towards the appendix. The gall-bladder was found greatly distended, and upon being opened a large amount of fluid and several stones were found. The stones were slightly smaller than a split pea. The appendix was examined and found gangrenous. It was removed.

The patient made an uninterrupted recovery, but continued to discharge small stones until the eighth day after the operation.

Dr. Francis T. Stewart, speaking with reference to toxæmia following operations for cholecystitis, referred to a case under his care. The patient when admitted was suffering from symptoms that indicated violent cholecystitis. The condition came on acutely at 11 A.M., and operation was performed at 8 the same evening. Pus was found in the gall-bladder, and in the cystic duct was an impacted stone. The temperature was 102° F. before operation. Afterwards the tongue became coated, the face was flushed, and delirium developed. Later there was hæmorrhage from the bowel, the spleen became enlarged, the Widal reaction was positive, and rose spots appeared, the patient passing through a typical attack of typhoid fever. Cultures from the gall-bladder showed the

presence of streptococci. Dr. Stewart also mentioned a case in which he assisted Dr. Morton. The symptoms were those of an acute abdominal catastrophe, and the abdomen was found to be filled with bile. The bile was allowed to drain from the abdominal cavity, and it was not known if rupture of the gall-bladder had occurred. The patient went on to recovery without developing any evidence of toxæmia.

Dr. W. Joseph Hearn stated his belief that bile in the peritoneal cavity produces no more toxic effects than does any other foreign body. He cited the case of a man who was shot through the gall-bladder, with consequent escape of bile into the peritoneum; no toxæmia referable to the presence of bile developed. Cases of toxæmia similar to those reported are due to streptococcus or staphylococcus infection in addition to the bile.

Dr. John H. Gibbon cited cases of Dr. Willard and others in which bile from a ruptured normal gall-bladder had remained in the peritoneal cavity for long periods of time, in Dr. Willard's case for many months, without producing untoward effects. He agrees with Dr. Le Conte that micro-organisms produce the trouble in the beginning, and also the subsequent toxæmia. Intoxication results from the release of pent-up material in the gall-bladder.

Dr. John H. Jopson stated that he did not mean to imply that the symptoms in his case were due to absorption of bile, as he is not sure that they were. They came on a week after the bile was drained. As to septic infection, however, granulations had formed and walled off the wound, and the leucocyte count was falling, conditions in which one would not expect to find infection. He thinks that the symptoms were not due to an ordinary infection. Usually, bile is very well borne by the peritoneum.

Dr. William J. Taylor stated that he had reported his case simply as one of profound toxæmia which came on some time after operation and lasted a week or ten days. He has never seen any other intoxication resembling it.

Dr. Gwilym G. Davis detailed briefly the case of a man of seventy years who had gangrene of the gall-bladder which contained a calculus. An abscess outside of the gall-bladder was also present. The abscess was evacuated, the bladder removed, and drainage instituted. The patient did well for a week or two, then developed delirium, and later insanity. Death finally ensued. There was no evidence of peritonitis or sepsis.

Dr. Robert G. Le Conte said that the urine report in the case presented by Dr. Jopson was interesting and very suggestive. Previous to the time of the appearance of the toxic symptoms in the patient the analysis of the urine showed albumen, casts, and granular débris to be present. Coincident with the appearance of toxæmia, the urine cleared up and was apparently normal, suggesting, perhaps, that, owing to the failure of the kidneys to eliminate the toxic material in the blood, the constitutional symptoms of toxæmia had presented themselves. In other words, that as long as the kidneys were excreting the toxic products in the circulation no constitutional symptoms were present, but the moment they ceased this elimination the symptoms of toxæmia appeared.

SUPPOSED CARCINOMATOUS OBSTRUCTION OF THE PYLORUS NINE MONTHS AFTER POSTERIOR GASTRO-ENTEROSTOMY.

Dr. John H. Gibbon presented a woman, thirty-eight years of age, saying that his reason for reporting this case was that it illustrated the difficulty of making an accurate differential diagnosis between gastric cancer and ulceration of the stomach where there is a large amount of infiltration about the ulcer, and also the advisability of performing gastro-enterostomy even where the operation may seem useless because of the extent of the supposed malignant disease.

The patient was seen with Dr. Gamble and gave a typical history of gastric ulcer extending over eight years. Her family and previous history were of no particular interest. For eight years the patient had suffered from attacks of vomiting and gastric pain. She had also suffered pain soon after eating. The attacks grew worse, and six years ago she was confined to bed by one of them for three months. During this attack she had two hæmorrhages from the bowel, followed later by the passage of clots. She states that she passed no blood after this time. A year later she had another attack, which kept her in bed for a month. In both of these attacks there was severe pain in the right side and in the back. Two years ago she had an acute attack of vomiting and was very ill. The material vomited was very dark and said to contain blood. This is the only attack of hæmatemesis which the patient has had. During this attack she was confined to a hospital

in Philadelphia for six weeks, the diagnosis of gastric ulcer being made. In January, 1903, the patient was able to return to her work as a housemaid, at which she continued uninterruptedly until four days before Dr. Gibbon saw her, July 29, 1903. Three weeks before he saw her she began to have trouble with her digestion, and occasionally vomited a moderate amount, which greatly relieved her discomfort. During these three weeks she had more or less pain located above and to the right of the umbilicus, a feeling of distention of the upper abdomen, and constipation. When first seen by Dr. Gibbon she had a great deal of gastric pain and tenderness. The stomach was distended and contained a large amount of liquid food, which the patient had been able to take without any recent vomiting. The lower border of the organ extended some inches below the umbilicus. After examination of the abdomen the patient vomited an enormous amount of dark liquid, after which the stomach could not be outlined, and the patient felt more comfortable. At this time it was noted that there was a sense of resistance above and to the right of the umbilicus.

The patient was admitted to the Pennsylvania Hospital on July 29, 1903, and for eight days was fed entirely by the rectum. The second day after admission she vomited, the vomitus containing a quantity of undigested food and berry seeds, eaten some time before. The stomach was washed out at this time, and vomiting did not recur for some time. On August 1, after a test meal, there was found free hydrochloric acid, total acidity 65, combined acids 36, no lactic acid. The hæmoglobin at this time was 71 per cent. For the next three or four days the patient vomited a number of times, and the vomited material was found to contain blood. No blood was present in the stools, however. On August 7 Dr. Gibbon determined to do a gastro-enterostomy, and expected to find a benign obstruction of the pylorus. When the abdomen was opened, there was a mass involving the pylorus about the size of a lemon, which was hard and appeared to be a cancer. The glands of the lesser omentum were very numerous and large. The patient was not in the best condition, and it was thought unwise at this time to do a partial gastrectomy. A gastro-enterostomy after the method of Moynihan with the Doyen forceps was done, and it was hoped that if the patient recovered from this operation that a partial gastrectomy might later be performed. The patient made a good recovery from the operation, and on the second day was

able to take and retain liquid food. On the fifth day after operation, preceded by a night of considerable pain, there was some distention of the abdomen, which was relieved by an enema; the result of the enema was a large, dark-colored bowel movement. The patient continued to complain of considerable pain at night in the right side of the abdomen. On the tenth day after operation she vomited a small amount of brownish fluid containing small blood-clots. Twenty days after operation there developed a phlebitis of the left leg. This, however, subsided after a day or two, and the patient's condition was much better. On the 11th of September the patient was out of bed and doing well. She was discharged from the hospital on the 21st of September, 1903, a very unfavorable prognosis being given to her relatives. On the 14th of October she had gained both weight and color, felt perfectly well, was eating everything that she cared for, and her only complaint was the swelling of her leg. This was relieved, however, by an elastic bandage. On the 10th of February, 1904, the patient was seen again and presented no gastric symptoms whatever. She had continued to gain in weight, but complained of some pain in the epigastric region and back, which, however, was uninfluenced by the taking of food. This disappeared, and the patient resumed her work as a chambermaid. The pain in the back, however, was sufficient to make her discontinue the work after three weeks. During all this time she continued to take ordinary food without the slightest discomfort. At the present time the patient states that she is entirely free from pain, has no gastric symptoms, and has gained much in weight. Palpation of the abdomen does not reveal any mass whatever in the pyloric region, and the patient's appearance is that of a healthy person.

In view of the condition of this patient nine months after operation, it is thought that she undoubtedly did not have a cancer at the time of operation, but a pyloric ulcer with extensive infiltration about it. It is thought that the case shows the advisability of exploratory operation even where a supposed cancer of the stomach has advanced to the point where it can be palpated through the abdominal wall, and also that in such instances, where there may be the slightest doubt as to the diagnosis, a gastro-enterostomy is advisable.

Dr. Gibbon also referred to another case of perforated gastric ulcer which he reported before the Academy last fall, and reported

in "American Medicine," in which the condition of the stomach about the ulcer so closely resembled a malignancy that, had not perforation been present, a diagnosis of gastric cancer would have undoubtedly been made. This patient was operated upon October 1, 1903, and is now in perfect health.

Mr. Collinson, of Leeds, England, noted particularly the statements of Dr. Gibbon that the glands in the lesser omentum were involved; enlargement of these glands is quite constantly seen in cases of ulcer of the stomach, and if, in addition, there is extensive induration, one is apt to be led to the diagnosis of malignant disease. The case reported by Dr. Gibbon emphasizes what has been said by Robson, Moynihan, and others, and no doubt explains the remarkable way in which supposed cancer of the pylorus is cured by gastro-enterostomy, the explanation being simply that such cases are in reality those of severe gastric ulcer. The after-history of occasional vomiting by Dr. Gibbon's patient is also interesting. In many cases one sees after operation these attacks, which later entirely disappear. Mr. Collinson is not sure of the explanation of this phenomenon, as it occurs even when the anastomosis is made at the lowest part of the curvature of the stomach, a point which is much insisted upon by experienced surgeons. Vomiting more frequently occurs in cases where the anastomosis is not made at the most dependent point, but the fact that it does sometimes occur in ideal cases is proof that the site is not alone responsible for this annoying sequel.

Dr. Richard H. Harte reported briefly a case similar to that of Dr. Gibbon's. The patient was a man about forty-five years of age, who had a large indurated mass in the pyloric region simulating malignancy, and his age lent weight to this supposition. On exploration the mass was found to be caused by the induration following a chronic ulcer. A gastro-enterostomy was performed, and the patient since that time has steadily improved and gained in weight, and all gastric symptoms have disappeared. Had not this case been operated upon, the case might have been put aside as one of malignancy, and the patient would gradually have worn himself out as the result of the chronic irritation about the pylorus, due to an old ulcer. Dr. Harte feels convinced that many of these cases of presumable malignancy can be greatly benefited by operation, and would advise in all doubtful cases that an exploratory operation be performed; if conditions are such as to indicate a posterior gastro-enterostomy, it should be performed.

TRANSACTIONS

OF THE

CHICAGO SURGICAL SOCIETY.

Stated Meeting, April 4, 1904.

The President, E. Wyllys Andrews, M.D., in the Chair.

METAPNEUMONIC EMPYEMA.

Dr. Arthur Dean Bevan showed a young man who gave a history of pneumonia and a metapneumonic empyema. A rib had been resected and an empyema of the left side drained eight months before by another surgeon, after which the opening closed. This was followed by a reaccumulation of the fluid, and when Dr. Bevan saw the patient the entire left side of the chest was full of pus up to the clavicle, and the apex beat was in the middle line. There was a small discharging fistula in the third intercostal space two inches to the left of the sternum, and through this a probe could outline the entire cavity. The patient was septic and in bad condition. An extensive U-shaped incision was made and the soft tissues lifted up. A resection was made from the third rib to the tenth inclusive. This was done subperiosteally. After lifting up the very large flap, and after the resection had been made, all of the intercostal tissues, including the pleura, which was three-quarters of an inch in thickness, were cut away with strong scissors. The U-shaped flap was then drawn down and a tube as large as the thumb introduced to the apex of the cavity and the flap stitched in position. Some gauze was also packed in. The operation was done the 7th of January. The patient had some sepsis for a considerable period after the operation, about ten days; in other words, the temperature continued. However, this condition gradually improved. About four weeks after the operation, an outline of the cavity which remained

was obtained by injecting iodoform emulsion into the cavity, sealing the opening, and taking an X-ray picture. The skiagraph showed a fine ribbon-like cavity which reached almost to the clavicle. The patient was then put at work blowing up an air-bag. Every day, as he blew up the air-bag, expansion of the compressed lung was effected by the forced expiration used. As a matter of fact, there was apparently no lung tissue on the left side at the time of the operation. Now, there was a fair amount of lung tissue occupying the upper left apex. The entire wound had healed. Patient was now practising gymnastics, and his general condition was excellent.

Dr. Bevan stated that this was the seventh or eighth Schede operation he had done, and it was the most satisfactory one of the entire group. He thought the excellent result was due primarily to two facts,—very extensive resections of the ribs, including the pleura, which latter he had omitted in some of his cases, and to the use of an air-bag, as stated, to expand the lung at the apex. In most of his previous cases he had failed to obliterate the cavity at the apex, or else it had required a long time to accomplish it.

He showed three skiagraphs, one showing the case before the operation; the second when there was still a ribbon-like cavity containing iodoform emulsion, and a third showing the case as it was to-day completely cured.

CERVICAL RIB.

Dr. D. N. Eisendrath showed a skiagraph from a patient, fifty-six years of age, who had consulted him on account of recurrent hæmorrhages apparently from the lungs. During an examination of the chest, while palpating above the left clavicle, a hard mass about the size of a fist was detected. Careful examination showed this to be a cervical rib. An X-ray picture taken showed well the cervical rib.

Dr. Eisendrath stated that there were four types of these cases,—one in which the cervical ribs were complete and articulated with the sternum; the second type, in which they were usually from three to four inches in length, and articulated with the first thoracic rib, or with the sternum by means of a ligament, and two other forms in which they were rudimentary, one being

about an inch in length, and a fourth, in which the cervical rib was simply a tubercle projecting from the transverse process.

As regards the origin of this cervical rib, the only way one could understand it was to consider it as a reversion of type of the mammalia towards some of the elementary forms. This cervical rib existed in reptiles. It must be regarded as an abnormal development of the anterior nucleus of the transverse process of the seventh cervical vertebra.

PSEUDO-ATLANTO-AXOID DISLOCATION.

DR. EISENDRATH presented skiagraphs which were important from a medicolegal stand-point.

During the month of December, there was tried in a Chicago court the case of a young woman who had alternating attacks of paralysis of the lower extremities, attacks of blindness, paralysis of the left upper extremity, and who claimed to have sustained an injury as the result of being pulled up on to a car platform by a conductor. The case seemed to be one of pure hysteria, but two X-ray pictures were exhibited by her lawyer, which apparently showed a dislocation of the atlas upon the axis. The speaker was called in the case as an expert, and after having been shown the skiagraphs gave as his opinion that the case was a sham, and in order to prove that this was not a dislocation of the atlas upon the axis, he had an X-ray picture taken of his own spine.

The first skiagraph he presented showed the normal spine where the atlas rests upon the axis. The second picture he had taken with his head in the same position as that in which the skiagraph of the woman's head was taken, the head stretching forward, and he thought, unless this skiagraph was labelled, it would be mistaken for a dislocation of the atlas upon the axis. It hardly seemed possible that a normal human being could produce such a dislocation. However, it was one of the great points of contention in the case, in that it was simply shown what could be done by the normal human spine. He thought this was simply the beginning of the possibilities of studying practical normal skiagraphs.

ADENOMA OF THE MUCOUS GLANDS OF THE LIPS AS A CAUSE OF MACROCHEILIA.

DR. D. N. EISENDRATH read a paper with the above title, for which see page 320.

RESULTS IN ABDOMINAL WALL SUTURE.

Dr. Charles Davison read a paper with the above title, for which see page 373.

Dr. A. J. Ochsner said there were three elements which must be considered in the closure of abdominal wounds. The first one was accurate coaptation; second, an aseptic wound, and, third, the absence of pressure necrosis. He thought all of these elements were taken care of by the method that had been described. The method made it necessary to have the layers distinctly in view, because the suturing could not be accurate unless one had these layers in mind.

Silkworm gut was easily rendered aseptic, and it was almost impossible to make it septic during an operation. The fact that one had a long silkworm-gut string, which passed in and out, made pressure necrosis impossible, because it did not definitely constrict any given point of tissue.

It was foolish for one to say anything about one's personal experience with postoperative hernia without having followed all of his cases, so that he would not say what could be expected in this regard. But he knew that if these three conditions were carried out, it did not make much difference what suture material was used, or what particular method one employed, one would not get postoperative hernia.

Last year he had approximately 740 abdominal sections, and of this number he did not believe there would be a ventral hernia in any case in which the three principles referred to were employed.

Dr. D. N. Eisendrath had seen the method of Dr. Davison used very satisfactorily. Personally, he had had practically no experience with it other than to assist in some operation in which it had been employed. To one point he would like to call attention. From the umbilicus downward, practically the anterior sheath of the rectus was made up of the aponeurosis of the three muscles, so that if these were pulled together tightly it was the greatest factor in the prevention of hernia. The point that seemed difficult in Dr. Davison's method was how the sutures could be pulled out afterwards, especially the deeper ones, say, in a case of umbilical hernia. He asked Dr. Davison whether he had experienced any difficulty after ten or twelve days had elapsed in unloosening the pseudo-knot and removing the sutures. The

subcutaneous suture enabled one to get the most beautiful line of union in the superficial lines except at the ends of the wound.

Dr. Wm. M. Harsha said he had used Dr. Davison's suture in probably twenty or more cases. There had been no hernia in any case that he had been able to follow up; but the skin cicatrix had spread in some cases. There had apparently been no giving way in the fascia, so far as he could tell, or in the peritoneum. In fat patients, in cases where the layer of adipose tissue is quite thick, while the belly of the muscle came together between fascia and peritoneum, the fat did not seem to bulge out, and the skin in some cases had stretched over. This had been one difficulty he had seen in the cases he had operated upon by this method. He had had no case of infection. By this method it made the neatest and nicest scar when one took the sutures out.

Dr. C. C. Rogers had used the Davison suture in eighteen cases, five of them being emergency cases, the others hospital cases, with one case of infection. This patient recovered in five days after the removal of the stitch. In thirteen cases there had been no hernia, so far as he knew; the others he had not seen or heard of recently. He had had no difficulty in removing the stitches. To prevent spreading of the scar of the skin referred to, in fat subjects, where the abdominal fat was thick, he inserted an extra stitch, suturing the fat together with a continuous stitch and bringing out the ends, as the skin and peritoneum were stitched, in that way obviating any dead space.

Dr. Carl Wagner said he had used the longitudinal wire suture in several cases, but had abandoned it on account of the wound in two cases having opened. He thought the wire was too stiff, and that silkworm gut was preferable, in that it was much smoother and more elastic.

Dr. E. Wyllys Andrews said that one virtue of the longitudinal silkworm-gut stitch lay in the fact that it was semirigid and semiflexible, becoming moulded to the tissues and not stretching. With regard to the subcuticular stitch, he had used it in hundreds of herniotomies. In the case of a long incision, for example, like that posterior to the sternomastoid muscle in an operation on the glands of the neck, it was better not to insert the subcuticular stitch in one long piece, because, when one came to remove it, it would break so easily. The late Dr. Fenger had taught this. He had found it out in his own experience. One

should begin at the ends and make the two pieces meet, so as to draw it out in two parts. He thought wire had the same rigidity combined with flexibility as gut, and greater strength for the same diameter. The secret of getting out these wires easily afterwards lay in one step of the technique, which was this: As soon as one had finished the stitch, he should grasp the two ends of the wire strongly and seesaw it as he would with a chain-saw. This straightened the wire, so that it did not look like a wavy line, but a straight line, and the tissues became a wavy line. The wire was perfectly loose in the tissues, just like a harelip pin, when two weeks after its insertion one pulls it out straight.

Dr. Davison, in closing the discussion, said that credit should be given to Halsted, of Baltimore, as the originator of the subcuticular stitch. The first he knew of the longitudinal stitch being used was from a description of it by Haughey, of Ann Arbor, in 1896. At about the same time Haggard, now of Nashville, but at that time an interne in a New York hospital, used it, failed to get it out, and quit its use. The only thing he claimed which was original with himself was that he used the knot which fastened the silkworm-gut suture in position. Every other element of it had been in use for a long time. With silver wire one could not tie a knot and get the wire out again without breaking it. He experimented carefully for a year with many cases without a knot, and while the majority of them were all right, every once in a while the suture would pull out, thereby causing the wound to spread.

Silkworm gut was elastic and tended to straighten itself. If it were allowed to remain in the tissues for, say, two weeks, it would produce a microscopical area of pressure necrosis around it, which made it easy to remove. There were three elements which interfered with getting a silkworm-gut suture out: (1) Imperfect silkworm gut. If one used silkworm gut that had been treated with chemicals in its sterilization, it was likely to fray, and it would catch and split. He obtained the best selected strands of silkworm gut he could procure, the largest, strongest size Spanish silkworm gut. One should be careful to get gut that was strong, perfectly round and smooth, so that there would be no catching, not treated by chemicals at all, but simply boiled previous to operation, which made the strands soft and pliable like a string. (2) The next defect was back stitching. In working

in a deep wound, if one was not careful he would back stitch in going from side to side in the fascia. If this was done, one had to break the gut at that point to get it out and remove it in two parts. (3) The position of the patient when the sutures were being removed. When the patient lay on his back, as one frightened him in removing the stitches, he made tense all the abdominal muscles and interfered with the removal; whereas, if the shoulders were elevated on the pillow, the legs and thighs flexed, the abdominal muscles were relaxed, and the stitches could be removed more easily. Usually he cut the stitch off an inch longer than necessary, for the reason that in case it should break off he had something to pull it from the other side, cleansing it each time before attempting to pull it out. He rolled the proximal end on a gauze sponge and artery forceps; he bit on the covered strand, rolled the sponge and strand around the artery forceps, and when the patient was in the right position he held the artery forceps just like a cork-screw and made gradual traction, thus removing the sutures.

As to widening of the scar, he had been operated on for appendicitis himself; this stitch had been used, and he had had ample opportunity and chance to examine it. If there was much fatty tissue, there would be absorption of the superficial part of the skin, and perhaps widening of the scar, but this absorption would occur in the injured part of the cuticle. If there was fat of any consequence, he would put in an extra stitch through the fat back and forth, which would obliterate a dead space, so that there was no chance for blood to accumulate. If blood did accumulate, each strand acted as a capillary drain, draining the blood into the dressings.

In all of his series of operations he had never had to tie an artery in the abdominal wall; he had always succeeded in arresting hæmorrhage by torsion or by pressure of one of the sutures.

As to long abdominal incisions, if he were to make an unusually long abdominal incision, he would insert the sutures in sections, making of them complete sets as if there were separate wounds, not to put any great length of silkworm gut in a single wound. He had made the sutures four, five, and six inches long and removed them without any trouble.

He wanted to say, again, that the only claim of originality he made was the use of the knot which fastened the longitudinal suture in position.

RESECTION OF FOUR FEET OF SMALL INTESTINE FOR PERFORATION OF THE UTERUS DURING CURETTAGE.

Dr. William Hessert said that the case whose report follows is of such an unusual nature that its publication is deemed justifiable. Perforation of the uterus during curettage is an accident which occurs not infrequently, but the reports of cases are obviously not found in the literature. It has occurred not only in the hands of the novice, but even the more expert have at times committed this blunder, not to mention the many fatalities in the hands of midwives, or where the wound was self-inflicted by the woman. All with any experience with curettage for incomplete miscarriage can testify that sometimes unusual care is necessary to avoid perforating the thin, soft uterus. A curettement at all times, but especially of a pregnant uterus, is an operation which should demand the greatest care. It should be preceded by an accurate anatomic and pathologic diagnosis of the pelvic condition, and its performance guided by the carefulness and judgment which come with experience.

The patient, a woman of forty-six years, and the mother of five children, had a miscarriage, and curettage, one year ago. She had become pregnant again, and had an incomplete miscarriage at the third month. She was attended by a midwife, who called her regular family doctor on account of hæmorrhage. The doctor attempted to empty the uterus without an anæsthetic, but found this impossible, so he packed with gauze. Next morning the patient was put under an anæsthetic at her home, for curettage. Her general condition was good, and there was only a slight rise of temperature. A pair of Goodell cervical divulsers was introduced into the cervix and the blades separated. After accomplishing what seemed sufficient dilatation, the blades were withdrawn and a placental forceps introduced. Something soft and slippery was felt in the grasp of the forceps, which was supposed to be membranes and placenta. After some traction and twisting, a mass of material was delivered on the towels outside. On closer inspection it was found to be a two-foot loop of small intestine. The gut was then hastily pushed back in the direction from whence it came, and after tamponnade of the vagina further operating was deferred.

The writer saw the case in consultation in the afternoon,

about four hours after the above incident. The woman had recovered from the effects of the anæsthetic. Her general condition was fair; pulse 120, of fair quality, but somewhat intermittent; temperature 101° F. She complained of no pain, only felt weak. Heart and lungs negative. Abdomen soft and not distended, and examination was negative save for some slight tenderness in hypogastric region. Urine negative. The packing in vagina was not disturbed. On the basis of the history, an immediate laparotomy was demanded, and the patient removed to the hospital.

Operation.—Seven hours after first operation. Abdomen and external genitalia carefully prepared, including vagina, from which tampon was removed. No gut seen protruding from cervix. The latter was large and patulous, but presented nothing abnormal in appearance. Median incision above pubes. About two ounces of fresh blood-clot in pelvis, but no active bleeding anywhere. A loop of small intestine was lifted out from pelvis; it was completely detached from its mesentery. All the detached portion of intestine, together with the mesentery, was now delivered outside of the abdomen. One loop of gut entered a small rent in the anterior surface of the uterus. On making slight traction this portion was pulled out. On surveying the damage, it was revealed that the gut for a distance of over three feet was completely severed from the mesentery, no portion of the latter being adherent to the gut. The latter was separated from its mesentery as clean as one does in the post-mortem room. There was, of course, an absolute indication for resection, as this section of intestine was completely deprived of its blood supply.

The intestine was not distended; it was somewhat dull and livid, and presented some hæmorrhagic areas here and there. There was no perforation.

A typical end-to-end anastomosis was done, using the Murphy button. Four feet of intestine were removed. The free end of mesentery was trimmed, the larger vessels ligated with catgut, and the free edge brought together with a running catgut suture. Pelvis swabbed clean of clots, there being no escape of fæcal matter. The uterus was retroflexed and about the size of one's fist. On the anterior surface, midway between the internal os and the fundus, there was a transverse opening, two and one-half centimetres long, just large enough to admit the index-finger. The false passage led diagonally through the wall of the

uterus, terminating at the internal os, this being also the point where the direction of the cervical canal took its backward dip. Cavity of uterus explored with finger, and no placental débris detected. It was practically empty. With a curved dressing forceps a strand of iodoform gauze was inserted into the false passage, so that it would emerge into vagina. The other end of the gauze was then packed into the uterine cavity. The wound in uterus was now closed with three deep catgut sutures. There being no other injuries, the abdomen was closed in the usual manner, without drainage. A gauze tampon inserted into vagina, and one litre normal salt infusion given by infusion.

Patient left the operating room in fair condition; pulse 130.

Subsequent History.—There was little shock following the operation, but the patient was given another litre of saline solution per infusion the same night. For several days the pulse was irregular, but finally became regular and the rate about 100. Temperature did not rise over 100° F. Small amount of bloody flow for a few days. Tampon and uterine drain removed on third day, and not reinserted. Liquid diet, but no milk allowed. Bowels moved spontaneously on second day, and every day after, by enema, if necessary. Suture removed on eighth day; healing by primary union. Button passed on tenth day. Left hospital after three weeks, entirely well, although somewhat weak.

CARCINOMA OF THE HEAD OF THE PANCREAS.

Dr. Hessert showed a specimen of carcinoma of the head of the pancreas. The history of the case as given briefly was as follows: The woman was seventy years of age and had been previously healthy. She was seen four months ago on account of jaundice. The latter for several weeks was mild, and there were scarcely any other symptoms. Stools clay-colored, bowels costive; no pain, and never any pain previous to present illness. Examination of abdomen negative. After four weeks' duration the jaundice had deepened, there was considerable itching, diminished appetite, and general weakness. Examination showed liver to be somewhat enlarged and generally tender. No tumor could be made out; urine contained bile and small amount of albumen. After six weeks' duration of the trouble there was still no subsidence of the symptoms, as might be expected in an ordinary case of catarrhal jaundice. Furthermore, the liver was still more

enlarged, and he thought that he could feel a mass vaguely deep in the right hypochondriac region. The question of malignancy arose, and he called Dr. Favill in consultation. The diagnosis lay between gall-stones, catarrhal icterus, and cancer. The utter absence of pain spoke against gall-stones; the clinical course pointed to a graver disease than catarrhal icterus; a diagnosis of probable malignancy was made.

The day following the consultation the stools became bile-stained again, and patient felt somewhat better.

The patient gradually became worse, the icterus was intense, and the usual cachexia finally ended in death four months after onset of symptoms. It is noteworthy that there was never any pain until near the end, and then not severe.

During the last month or two the ascites and enlargement of the liver made deep palpation impossible. The itching had also entirely subsided.

At the autopsy, exploration was first made with the hand; the distended gall-bladder contained no stones, and none could be felt in the common duct. He was surprised not to find a large tumor mass, and the only feature palpable was what appeared to be some hardening and enlargement of the head of the pancreas. The duodenum felt normal. When this is compared with the later findings, it is evident that in the performance of an exploratory operation a tumor such as this one might easily be overlooked. The liver, pancreas, and duodenum were removed *in toto*. The former was greatly enlarged and the gall-bladder much distended, as were also all the ducts. The head of the pancreas was enlarged to twice its natural size, and was indurated. On cutting open the duodenum there presented at the site of the papilla a cauliflower-like mass the size of a half dollar. It was elevated one centimetre above the surface of the gut, and was somewhat hard in consistency. Its summit was eroded. On making considerable pressure on gall-bladder, a small amount of bile exuded from an opening in the centre of the mass. A small probe here inserted was caused to enter the common duct. A microscopical examination had not yet been made, as the specimen was preserved intact for gross demonstration. There were no stones.

APPENDICITIS, WITH PERFORATION OF THE DUODENUM.

Dr. D. W. Graham reported the case of a man, aged thirty-seven years, who was admitted to the hospital June 12, 1903. Four years before, he had had a sudden severe attack of pain in the upper right quadrant of the abdomen, with fever, nausea, and vomiting, on account of which he was bedfast ten days. Since then there had been three or four similar but less severe attacks. On admission he gave the history of another attack, beginning three weeks before. Temperature, 102° F.; marked rigidity and pressure pain over right hypochondrium. The pain and nausea had noticeably diminished three days before, coincidently with an attack of diarrhœa. There were not now, nor had there been at any time, distinctive symptoms referable to the gall-bladder or the kidney. There was no tenderness over the cæcum. The diagnosis was suppurative inflammation of uncertain origin, but probably connected with the gall-bladder or an abnormally placed appendix. Operation the following day. The usual gall-bladder incision revealed the gall-bladder practically normal and free from stones, but inflammatory adhesions of all the neighboring viscera were found. Following the lines of cleavage pus was discovered well back towards the posterior abdominal wall. From one to two ounces were removed by sponging as it appeared. There was nothing in the pus or the abscess cavity that would indicate the cause of the suppuration. A large counter-tubular drain was made through the loin, with the inner end of the tube in the abscess cavity. The operative wound was closed without drainage. On the following day the discharge through the lumbar drain became profuse and contained bile. It was soon discovered that fluids taken by the mouth would shortly appear in the dressings with large quantities of bile. On the third day, the patient not doing well, the operative wound was opened, some pus found, and drainage established. The patient died on the tenth day.

In the autopsy the appendix measured eleven centimetres in length and was found to pass directly upward behind the ascending colon, its free end being adherent to the psoas muscle and lying behind the curve of the duodenum and attached to it. Six centimetres from the pylorus, and on a level with, and three centimetres to the right of, the biliary papilla was a perforation of the posterior duodenal wall three millimetres in diameter.

The specimen presented showed the relation of the appendix

to the colon, the abscess cavity, and the duodenum. The tip of the appendix, which is bulbous, shows a small perforation, and it forms a part of the abscess wall. The lumen is pervious throughout, and is free from fæcal concretions. The relations and position of the duodenal perforation are also well shown.

These findings account for and explain everything in the history of the case, both before and after the operation. When bile and other liquids began to appear in the drainage, perforating ulcer of the duodenum was suspected as the primary lesion. The patient died of suppurative peritonitis, though the infection was limited to the area between the liver and the original focus. The use of the lumbar drain in this case was correct, although in a similar one he would drain through the operative wound as well.

AMŒBIC ABSCESS OF THE LIVER, WITH COMPLICATION.

Dr. Graham also reported the case of a man, thirty-seven years old, who had never been out of the State of Illinois, a free drinker of whiskey for years, who was admitted to the hospital October 26, 1903. Present trouble began July 19, while walking in the street, with a severe pain in the epigastrium followed by a chill, high temperature, and diffuse abdominal pain. Five weeks later the pain became localized about the right costal arch, and especially marked on deep respiration. He has had no jaundice and no tarry stools. No appetite. Has lost sixty pounds. On examination the liver was found much enlarged, with a friction sound caused by the respiratory movements. The daily temperature ranged from 98° to 103° F. The leucocyte count at this time was 11,000; two weeks later, 15,500. A few days after admission, large quantities of pus appeared with the fæces, with amelioration of the symptoms. This continued for three days. The patient came into his care through Dr. Sippey with the diagnosis of suppuration in the liver. Operation, November 5. The under surface of the right lobe of the liver was very much swollen, projecting forward and downward, and adherent to the colon. Two quarts of pus were removed. Large tubular drain with packing. The pus was sterile so far as could be determined by repeated microscopical and culture tests. No amœbæ could be found in the stools either before or after the operation. Notwithstanding the free discharge of pus which continued, the patient did well for a week following the operation. Then the

sutures of the abdominal wound were cut out and the borders began to slough. In spite of two radical attempts to arrest it by the free use of the knife, scissors, and curette, besides the continued use of the usual antiseptics, the sloughing persisted, and the patient died of exhaustion the thirty-second day after the operation. The sloughing wound extended from Poupart's ligament up onto the chest wall and was eight inches in width. Except at the upper part of this area the peritoneum remained intact. Cultures from the sloughing borders showed only staphylococci and streptococci.

The specimen shows (1) the large sloughing wound of the abdominal wall, which has been preserved intact; (2) the adhesion of the liver to the colon, which represents the point where the abscess was partially evacuated through the colon wall before the operation; (3) the abscess cavity in the liver as large as the fist, notwithstanding the contraction that has taken place; (4) many small abscesses through the liver; (5) numerous ulcers in the mucosa of the colon, with sloughing undermined edges and intercommunicating by channels underneath the mucosa, having all the characteristic features of amœbic ulceration.

The special interest in this case centres in two points, namely, the cause of the abscess and the complication.

While amœbic abscess of the liver is common enough in Southern climates, it is rare for the affection to originate in this latitude. As to the complication, the progressive melting away of the abdominal wall under the influence of ordinary infection, notwithstanding its accessibility and the ease with which the infection could be subjected to every available means for combating it, shows to what extreme degree the tissues may lose their power of resistance from systemic debility.

REVIEWS OF BOOKS.

Von Bergmann's Surgery. A System of Practical Surgery. By Drs. E. von Bergmann, of Berlin; P. von Bruns, of Tübingen, and J. von Mikulicz, of Breslau. Edited by William T. Bull, M.D., of New York. Volumes II and III. Philadelphia: Lea Brothers & Co., 1904.

The first volume of this system of surgery has recently been reviewed in the Annals of Surgery. The first volume dealt with the Head, the second deals with the Neck, Thorax, and Spinal Column, and the third considers the Surgery of the Extremities.

The list of contributors to the second volume contains the names of v. Angerer, v. Bruns, Erhardt, v. Eiselsberg, Henle, Hofmeister, Jordan, Kümmell, and Riedinger.

In Volume II, von Eiselsberg contributes the chapter on Diseases and Injuries of the Thyroid Gland, which constitutes one of the best treatises of the book. It is not explained why the authorship of the chapters on Malformations, Injuries, and Diseases of the Neck, Larynx, and Trachea, and Mammary Gland is not given, an omission which detracts from the value of the work. For instance, v. Bruns's name is given as one of the contributors to the volume, but the chapters he wrote are not designated. Some of the anatomical plates, which are beautifully reproduced, bear no explanatory texts.

In Volume III Hoffa's contribution on Malformations and Injuries of the Hip and Thigh is one of the most important in this volume. He presents very fairly the methods and surgical procedures of other surgeons, such as Lorenz, Mikulicz, Schede, and others, at the same time expressing his own conclusions on the subject. His chapter on Congenital Dislocation of the Hip-Joint is excellent. The section on Amputation at the Hip-Joint by the

same author is remarkably poor and incomplete. The method of Wyeth, so successfully and extensively used by American surgeons, is not even described, but is simply mentioned in passing as a complicated and unnecessary procedure.

In this volume many X-ray pictures are reproduced, and add greatly to the value of the work. Rarely is the old schematic drawing seen.

The general arrangement of the work is excellent.

PAUL M. PILCHER.

ORTHMANN'S HAND-BOOK OF GYNÆCOLOGICAL PATHOLOGY. Translated by C. HUBERT ROBERTS, M.D. (Lond.), F.R.C.S. (Eng.), M.R.C.P. London: John Bale, Sons & Danielsson, Ltd., 1904.

This work, which is a translation from the German, is intended to assist the gynæcologist in making his own microscopical diagnoses. The first section of the book is given to a brief description of the most modern methods of general pathological technique. The remainder deals with the diagnosis of pathologic conditions of the various parts of the female generative tract. The descriptions are as concise as thoroughness will allow, and the uncommon conditions are only briefly considered. The chapters on New Growths of the Uterus and affections of the Fallopian tubes are especially instructive. The text is interspersed with seventy-three excellent illustrations, mostly all original. The book is a valuable contribution to the literature of gynæcological pathology.

WALTER A. SHERWOOD.

ELEMENTS OF SURGICAL DIAGNOSIS. By A. PEARCE GOULD, M.S., F.R.C.S. Third edition, revised and enlarged. Chicago: W. T. Keener & Co., 1903.

In this new edition the whole text has been revised and many additions have been made. A section on the Diagnosis of the

Intracranial Complication of Middle-ear Disease has been added to the chapter on Diseases of the Head, and the chapters on the Diagnosis of Abdominal Diseases have been considerably enlarged.

In its scope, the book covers the entire field of the diagnosis of injuries and surgical diseases of the body, the two being considered separately. There are no illustrations and the print is small. The arrangement of the text is somewhat confusing, owing, no doubt, to the condensed form in which the subject is presented, and the fact that the direct and the differential diagnosis are not clearly enough defined.

The book contains a wealth of valuable information and is thoroughly practical.

PAUL M. PILCHER.

CASE TEACHING IN SURGERY. By HERBERT L. BURRELL, M.D., and JOHN B. BLAKE, M.D. Philadelphia: P. Blakiston's Son & Co., 1904.

In this small volume are detailed the salient features in the histories of seventy-five selected surgical cases. On the page opposite each history is left a blank space, in which the student is expected to supply the diagnosis, prognosis, and methods of treatment. The idea is a good one, and should prove to be a valuable aid to instructors as a means of assisting them in didactic and clinical instruction.

WALTER A. SHERWOOD.

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ORIGINAL MEMOIRS.

ASEPTIC SURGICAL TECHNIQUE.[1]

MINIMUM REQUIREMENTS FOR ASEPTIC SURGICAL OPERATING IN A HOSPITAL IN WHICH THE PERSONNEL OF THE OPERATING ROOM IS PERMANENT.

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METHODS can best be tested under the conditions indicated by the subject of this paper because they imply that the responsibility rests upon one person at the head of the surgical work, and that he is permanently supported in his efforts by a staff of assistants who are directly responsible to him, and are consequently bound to apply the principles laid down as valid by their chief.

This makes it possible to develop certain definite methods which are applied constantly by responsible persons in a large series of consecutive cases, and if the methods should not be followed by satisfactory results, it is possible to locate the cause of failure, and to change the methods accordingly until they are satisfactory, and to eliminate such members of the personnel as may be found incompetent to carry out the methods contemplated by the plan.

In order to secure the best possible results, such a system

[1] Read before the American Surgical Association, June 14, 1904.

must be (1) simple and yet comprehensive; (2) it must be uniform, and (3), above all things, it must be reasonable.

Simplicity.—Any system which is complicated is certain to contain elements which will not be fully comprehended by some person who may be necessary to carry out some portion of the plan; and if any one point is omitted in a system, the result of the entire system cannot be satisfactory. Moreover, it is correspondingly more difficult to locate the cause of trouble in any given case.

It is true that many most complicated systems have furnished large series of successful results, but the results have in no way excelled those obtained by vastly simpler methods. Of course, so long as the useless complications in any given system are at the same time harmless, the results will be as satisfactory with as without them.

Uniformity.—One of the most important elements in the development of a satisfactory system lies in the uniformity with which it is practised by the chief. If the chief does not uniformly do the same thing in the same manner under the same conditions, it is impossible for his assistants to thoroughly acquire a system. Of course, it is wise to make changes in order to perfect every system, but this should be done only after careful consideration and not in a haphazard manner. In this manner the youngest assistant without responsibility can acquire the principles involved in the system, and as he continues in his service he will be able to carry out his part without doing mischief, because he has seen each step carried out many times before he is called upon for responsible action in the same direction.

Reasonableness.—Surgery is more and more coming to be a very reasonable, logical profession; and in developing a system of aseptic practice, one can count with much greater certainty upon the probability that every one concerned will carry out the details if he is expected to do things which would appeal to a sensible person, than if he is expected to go through an unreasonable routine performance.

The system must provide for every contingency, and each

element of the system must be carefully studied before it is established. Conditions differ vastly in different institutions, and it is consequently necessary to adjust each individual system so that it provides for all the conditions involved in any given institution.

There must be a definite responsibility which can be established best by having the chief take the blame for all failures. If the system is carefully planned, and the chief is judicious in the selection of his assistants, failures are to be looked for very rarely, and when they do occur, the indication is usually, barring accidents, of course, that there is some element of the system which requires further perfection.

I will briefly outline the system in use at the Augustana Hospital because we have practically all the conditions implied by the title of this paper, and because the system has been developed by constant effort during a period of fifteen years under the same conditions. The methods have been accumulated by visiting many hospitals in this country and abroad, and by weighing the current literature during the entire period since the introduction of antiseptic surgery. The chief effort has been to simplify the methods, at the same time striving to secure the best results.

Disinfection of the Patient.—Unless there is some special reason in the physical condition of the patient, the following steps are taken in his disinfection previous to performing any operation: He receives a full warm soap and water tub-bath on the day before the operation. For the disinfection of his alimentary canal he receives two ounces of castor oil, in the foam of beer, directly before taking his bath, and a large warm water enema on the morning of the operation, except in case of operations upon the rectum. In these cases the enema is given on the evening before the operation.

On the evening before the operation, the skin over the seat of operation is thoroughly scrubbed with green soap and warm water, then shaved, then scrubbed with strong alcohol; then a moist dressing of gauze saturated with a 3 per cent. carbolic acid solution is placed over the field of operation,

over this a large covering of absorbent cotton held in place with a gauze bandage completes the dressing. Just before the operation this dressing is removed and the surface again scrubbed with strong alcohol. For several years we always prepared the skin over the region of the operation immediately before beginning to operate, and found it perfectly satisfactory; but it consumed too much of our time, consequently we now have this done by the surgical nurse on the previous day.

Disinfection of the Operator and Assistants.—The most important precaution taken is to keep the hands out of pus. In dressing suppurating wounds, forceps and rubber gloves are used so as to prevent the hands from touching pus. The operations are performed early in the morning before any one connected with the wounds has made dressings. The fact that it is bad practice to soil one's hands with pus is impressed most forcibly upon every one connected with our work.

Aseptic cases are always operated first, and later those containing pus. In operations upon suppurating cases, rubber gloves are used at the present time; but in former years, by taking the precautions indicated above, practically no infections took place, although no gloves were used.

I operate upon alternate days, so that on the intervening days the same precautions can be taken in dressing the wounds, —no suppurating wounds being dressed until all clean wounds have been finished.

Every evening before retiring, the surgeon and all the assistants scrub their hands with the same care that is employed in disinfection before an operation. The assistant who has charge of the patients who are primarily aseptic has nothing to do with the patients who are not aseptic primarily from the character of their disease and *vice versa.*

The aseptic assistant prepares a table of all the cases which come under his care during this portion of his service, upon which he notes the names of the patients, the age, diagnosis, duration of disease, operation, number and dates of dressings, the result as regards the wound, the date of admis-

sion, and the date of discharge. This record is filled out every evening, and acts as a remarkable stimulant to careful and conscientious work; and the practical results are exceedingly satisfactory.

I speak of these conditions first because they go to form an aseptic conscience in those connected with surgical work, and upon this depends the condition of the wounds rather than upon any special method.

At the present time we wash our hands in an ordinary deep porcelain basinful of warm water, using green soap with a moderately stiff brush; then we carefully cleanse the finger-nails with the point of a dull scalpel; then we scrub them once more with a brush, and then with a piece of sterilized gauze in the deep basin, because the gauze seems to rub off all the loose epithelium more perfectly than a brush; then we wash off the soap under the faucet in a stream of warm, boiled water; then we wash in 1–2000 corrosive sublimate solution for a few moments and then with strong commercial alcohol. I have varied this plan from time to time experimentally, and have found that after washing carefully with soap and warm water and cleaning the nails and washing once more thoroughly our wounds remained aseptic. The same was true if we supplemented this by washing with a sublimate solution, with or without alcohol, or by washing with the alcohol without the sublimate solution. There is one point, however, that I insist upon, viz., that every one connected with the operation have a smooth, unbroken skin upon his hands, or wear rubber gloves. Both of the assistants and the surgical nurse wear rubber gloves during all operations, while I wear gloves only in operations in the presence of pus.

We are careful not to breathe or speak into the wound. Every one connected with the operation is constantly on guard to prevent accidental infection of anything which may touch the wound. One nurse alone touches anything coming in contact with the wound, her assistant does anything else that may be necessary.

Disinfection of Instruments.—All instruments, except knives, are boiled for half an hour in a solution of a tablespoonful of baking soda to the quart of water before they are put away after operations, and again before they are used. The knives are washed carefully with water and then rubbed with pads of sterilized cotton, saturated with alcohol, before and after using.

Disinfection of Silk, Silkworm Gut, Horsehair, Drainage Tubes, and Brushes.—This is accomplished by boiling in water for one hour, and preservation in 5 per cent. carbolic acid in water, or in strong commercial alcohol until used.

Catgut is prepared by immersing in sulphuric ether for one month, then for one month in strong commercial alcohol in which one grain of corrosive sublimate to the ounce has been dissolved, the solution being renewed once during this time. It is then preserved indefinitely in a solution of one part of sterilized iodoform, five parts of ether, and fourteen parts strong commercial alcohol. It is never handled by any one except my chief assistant and myself. It is never placed in water. This catgut will last seven to ten days in tissues, according to the size used. It is used for all ligatures both in the peritoneal cavity and elsewhere, and for all buried sutures except in herniæ and in the suturing of bones. For these purposes we employ a chromicized catgut lasting from twenty to thirty days, according to size. This is prepared after the following formula: The catgut is immersed in ether for one month, then in a solution prepared in the following manner: Dissolve one ounce of chromic acid in five ounces of water and add to this one quart of pure glycerin. Immerse the catgut in this solution for seventy-two hours, then wind on wooden boards or ground edged slides, such as are used for mounting specimens for microscopic examination, and place in a solution of one part carbolic acid in five parts of glycerin for two weeks, then preserve indefinitely in the iodoform-ether-alcohol solution described above. It is important to dissolve the chromic acid in water before adding the glycerin, in order to prevent an explosion. The catgut prepared by these

methods is strong, pliable, slightly antiseptic on account of the iodoform absorbed, and it is invariably sterile. We are careful, above all things connected with the use of catgut, never to draw our stitches too tightly, for fear of causing pressure necrosis.

Disinfection of Dressings.—All dressings are disinfected in a steam sterilizer, two hours being given for steaming and one hour for drying. The same treatment is given to aprons, sheets, and towels.

Disinfection of Everything coming directly in Contact with Wounds.—The basins, instrument pans, jars for dressings, etc., are boiled in soda and water for one hour, then wrapped up in sterilized sheets until used. The tables are scrubbed with soap and water and then with 1–1000 corrosive sublimate in water. They are always covered with a double sterilized sheet when in use. The ordinary pads of cotton and of gauze, sterilized in a steam sterilizer, are used in place of sponges in all operations.

Drainage.—Drainage is always used in very large wounds, such as breast amputations with removal of pectoralis major and minor muscles and axillary glands, also in thigh amputations, usually only for two to four days, never in herniotomies, except for strangulated hernia complicated with gangrene, nor in small clean wounds. The ordinary perforated rubber tube is employed.

It is always used in wounds which are primarily septic. In abdominal surgery we drain acute appendicitis cases if perforation or abscess formation has taken place. We always drain in gall-bladder operations and in suprapubic cystotomy; in pyosalpinx only if there is leakage of pus during the operation. Tubercular joints are tamponed with iodoform gauze. In empyema of the chest we always carry two drains through the cavity, resecting one or more ribs behind and making an opening between the ribs in front.

Whenever there is any doubt as to the aseptic condition of a wound, we drain. We have found the use of an ordinary leather punch very convenient for making the necessary perforations in rubber tubing.

In the abdominal cavity we use glass tubes open at the end, having a number of small perforations towards the lower end. A strand of gauze is carried to the bottom of the tube to act as a capillary drain. A piece of iodoform gauze folded about four double is placed over the glass tube, and the latter with this covering carried down to the point to be drained. In operations upon the pelvic organs, it is carried to the bottom of the cul-de-sac of Douglas.

In removing gall-stones from the common duct, a rubber drainage tube is fastened down upon the opening by means of an unchromicized catgut stitch, and a strand of iodoform gauze is sutured down upon the duct, above and below the opening in the same manner. The same method is employed to drain the gall-bladder after removing gall-stones in cases in which the organ is shrunken and cannot be attached to the peritoneum. This method, which was originated by Dr. Mayo, of Rochester, Minnesota, has been employed in many cases, and makes the otherwise serious operation of choledochotomy practically safe. This method is of such extraordinary value that I wish to emphasize it especially.

Irrigation.—We practically never use irrigation during operations, either in the abdominal cavity or elsewhere.

During the early days of my surgical work as an assistant, I observed that wounds in abdominal section healed more smoothly than in any other operations, and the only real difference in the treatment observable was the fact that no irrigation was used in connection with the former wounds, while it was invariably employed in others. I consequently applied the same plan of treatment to all wounds as early as 1889, and I have since constantly operated dry in clean cases, and since a number of years also in cases containing pus. We have treated wounds in circumscribed tubercular lesions by applying strong compound tincture of iodine, and then sponging the area with moist gauze sponges before tamponing with iodoform gauze or before closing with sutures. These wounds have progressed well; but I do not feel convinced that the iodine has been responsible for this fact.

In tuberculosis of the joints we have applied strong carbolic acid to the exposed surfaces of the bones for two minutes, and have then washed these parts thoroughly with strong alcohol until all of the carbolic acid seemed removed.

I am convinced that irrigation is rarely of any real benefit, and that it is frequently harmful in carrying septic material to portions which might have otherwise escaped infection.

In the treatment of wounds which come into the hospital in a septic condition, we sometimes employ constant irrigation with normal salt solution.

My observations have convinced me that it is an exceedingly simple matter to obtain primary union almost invariably if one has a reasonable system, *i.e.*, a system which keeps the attention of operator, assistants, and nurses constantly on guard to prevent accidental contamination.

Whenever some new method is on trial in any hospital or clinic every one is interested, and, consequently, accidental contamination is not likely to occur. It is for this reason that the various new methods are so successful in the hands of their originators.

In having each successive assistant make observations every day throughout his service, we accomplish a very similar condition, because any case of even the slightest infection will be investigated, and all the conditions will be observed which might spoil the young man's comparative record.

Contact Infection.—My observations have convinced me that the only form of infection which must be considered in surgery is contact infection. This is due to the introduction into the wound of septic material from unclean hands, instruments, sponges, or dressings, or from speaking or breathing into the wound.

It is such an easy matter to make instruments, sponges, sutures, and ligatures aseptic that there only remain the hands to account for. These can be made clean without difficulty and kept clean with proper attention, but it is this part of the system which is more frequently lame than any other. Everything that is to come in contact with the wound, the hands

included, is usually clean when the operation is begun, but it is quite another matter to keep these clean throughout the operation, unless every one connected with the operation learns to concentrate his attention upon the work at hand.

In this, again, simplicity is of great importance. The fewer persons who can infect the wound, *i.e.*, the fewer persons who come in contact with anything which in turn comes in contact with the wound, the less are the chances of one of these coming in contact with something which may not be aseptic and then again with the wound.

It is consequently best to have as few assistants directly connected with the operation as possible. In my own work, I alone touch the wound with my hands, and that as little as possible; my first assistant uses hæmostatic forceps and sponges, and the second assistant makes the field of operation as accessible as possible by the careful use of retractors. I handle the instruments myself, and there is but one nurse connected with the operation, and she handles the sponges, drainage tubes, dressings, as well as the sterile sheets, towels, and basins. The same nurse has assisted me in more than 5000 operations, and the same is true of my chief assistant.

Choice of Assistants.—The assistants are graded in the following manner: One chief assistant, three second assistants, and six third assistants.

The third assistants are chosen from the graduating classes of the medical schools and serve for a period of four months. From these the second assistants are chosen. The two from the year's list of eighteen who show the best practical qualifications receive the appointment of second assistants, their service being for a further period of eighteen months. Once in three years, an assistant who has shown during his previous services as second and third assistant that he is especially fitted to become a surgeon is chosen for chief assistant. Each second assistant has two third assistants to aid him in all of his duties. The latter have no responsibilities, however, and never come directly in contact with wounds.

The surgical head nurse is selected for her especial fitness

for the work. She receives a suitable salary and remains in her position permanently. She prepares all the dressings, sutures, and ligature material, sterilizes the instruments, supervises the preparation of the operating-room and the patient on the day previous to the operation. She has three assistants, who are undergraduate nurses, whom she instructs, but who do not come directly in contact with anything which comes into contact with the wound.

ASEPTIC SURGICAL TECHNIQUE.[1]

WHAT ARE THE MINIMUM REQUIREMENTS FOR ASEPTIC SURGICAL OPERATIONS IN HOSPITALS WHERE THE SURGEON IS ASSISTED BY A LARGE STAFF OF INTERNES AND BY NURSES FROM A TRAINING-SCHOOL?

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WHEN we realize to what extent a large general hospital is a sort of dumping-ground, as it were, for all kinds of septic material, and that in many of these institutions there is, every few months, some change in the personnel of assistants or nurses, and especially if the situation is still further complicated by a large staff of surgeons, whose services are interrupted, it must at once be evident, from the point of view of asepsis, under what disadvantages the surgeons of these hospitals do their work. Because of these manifest disadvantages, the task of attempting to simplify the various aseptic processes in use in such hospitals is a delicate one. And yet the number of aseptic precautions has now increased to such a degree as to make it desirable, for the sake of simplicity, and in spite of the good results usually obtained under the old methods, to determine, so far as is possible, which are the really essential parts of the process and which can be done away with. It is obviously impossible, in such a subject as asepsis, to state dogmatically the exact degree to which the various details may be cut down without danger. I shall, therefore, content myself with making a few general observations on the subject, endeavoring at the same time to make no positive statements unless I feel that the known facts justify them. In doing this, I shall pass over certain details, as being too trite for discussion, and limit myself principally

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to points which to some may appear not so obvious, or about which there may be difference of opinion. Most of the methods here advocated have been put into practice at the Boston City Hospital. It is not claimed that all these methods are better than any others, but simply that they represent one of the ways, consistent with simplicity, in which satisfactory results may be secured.

(A.) PREPARATION FOR AN ASEPTIC OPERATION.

Sterilization of Materials in the Steam Autoclave.—It is found that exposure of materials * in the autoclave to a pressure of fifteen pounds of saturated steam for one half-hour is all that is necessary, provided that the bundles are loosely done up and loosely packed, so that all parts of them are readily accessible to the steam. This is, of course, a great saving in time over former methods, at least, as I have seen them practised. The half-hour should start from the time the air has been completely driven out, and the pressure-gauge registers fifteen pounds. The suggestion for diminishing the amount of time in using the autoclave was made to me by Dr. Charles Harrington, of Boston. That one half-hour is quite sufficient in practice has been proved by the Pathological Department of the Hospital; in fact, bundles containing cultures of the hay bacillus, in its sporing stage, have been found sterile even after fifteen minutes in the autoclave at fifteen pounds' pressure. Salt solution is sterilized in flasks by exposure for one half-hour at ten pounds' pressure.

Preparation of Absorbable Ligatures.—At the Boston City Hospital, at the present time, sterile catgut and kangaroo tendon are furnished to the hospital by reliable dealers. It is thought that, as practically the entire business reputation of such dealers rests upon the sterility of their catgut, it is more likely to be sterile than when prepared in the hospital. Where

* Gauze dressings, sponges, strips, pads, gowns, caps, sheets and towels, silk sutures and ligatures, silkworm gut, silver wire, etc. In cas. there is not sufficient room in the autoclave for all these materials, the gauze dressings may be equally well sterilized by baking in an oven.

the hospital facilities justify it, however, undoubtedly the best method is to have it prepared in the institution itself, under the eye of the surgeon. This method has, of course, the additional advantage of being by far the most economical.

Operating Room.—Whatever may be the actual danger of air infection, direct or indirect, and pending the results of more definite experiments, the demonstrated existence of pathogenic bacteria in the air of large hospitals * is presumptive evidence of the necessity of *some efforts* looking towards their exclusion. Because of the general truth that the more dust in the air the more bacteria, our efforts should, naturally, be in the direction of diminishing the amount of dust which is in the room, and of keeping such as remains quiet, thus leaving the air as free from it as possible. Therefore, as belonging to "minimum requirements," it is necessary to mop the floor, wipe the walls, fixtures, and furniture with damp cloths, and to minimize draughts from all sources. It is presumably safer also to filter the air. That the room should be such as to be easily cleaned is self-evident. Chan-

* In order to determine whether the air in the surgical amphitheatre of the Boston City Hospital contained essentially the same number and variety of bacteria found in other hospitals, the Pathological Department, at my request, made exposures of Petri plates for different periods of time during the twenty-four hours. Their conclusions were:

"1. That at no time in the twenty-four hours is the air free from organisms.

"2. That more bacteria were found after the air had been stirred up, as after the morning cleaning and the class exercises. The smallest number were found between the hours of midnight and 7 A.M.

"3. The vast majority of the organisms found were harmless saprophytes, though in some plates of every series staphylococcus albus and aureus were found. The streptococcus was found in two instances only.

"4. There was no great difference in the number of colonies obtained at different levels, excepting on those plates laid upon the floor, where the number of colonies was much in excess over the other plates. This was due to the people who passed through the amphitheatre at all hours."

These results are essentially the same as those of other investigators, all of them going to show that while air infection may not seem to be enough of a danger to require more than ordinary precautions, yet the possibility of infection in this way should not be disregarded, especially in a large hospital.

deliers above the operating table, on account of their catching the dust, and because of the difficulty in cleaning them, should be as simple as possible.

It will be extremely interesting to note whether sweeping by the vacuum system, now so extensively used in office buildings, may not be of value in thoroughly removing the dust from operating rooms. By this method the loose dust is sucked up from the different parts of the room, through a nozzle at the end of a hose, and is carried to the basement. I am not aware, however, that as yet the system has been installed in any hospital.

The proper disposal of septic material is *essential.* The usual method of throwing it into a hopper is probably safe, though a description of the trap-door method, which I understand is now in use in Hamburg, sounds more attractive.

Thorough and systematic fumigation of the operating room with formalin gas is, in my judgment, essential; at least, after all septic cases.

It is possibly safer to have one room for septic cases, and another for clean ones; although it is not at all certain that, with careful cleansing and proper fumigation, one room is not sufficient to meet the "minimum requirements." The advantage of the common practice of allowing the operations on clean cases to precede those on septic ones is so obvious as to hardly need mention.

An operating room, then, which can be easily cleaned, and *which is cleaned,* where the air is kept comparatively free from dust, where draughts are minimized, and where formalin fumigation is regularly and thoroughly practised, must, for the present at least, be regarded as all that is necessary to meet the "minimum requirements." All elaborate or ornate fittings or furnishings, giving the *appearance* of cleanliness, are luxuries of questionable value, if indeed they are not positive dangers, as they tend to give a false sense of security.

Preparation of the Patient's Skin.—Experience seems to have demonstrated that in the preparation of the patient's skin no special aseptic precautions are necessary on the day be-

fore operation. The patient should be given a hot bath, and the operating area should be thoroughly cleansed with soap and water and then shaved. That further preparation of the skin is presumably unnecessary is shown by the fact—probably corroborated by the experience of most surgeons—that accident and other emergency cases, on which only a final preparation is made, seem to do just as well, aseptically speaking, as those cases prepared with great pains in the hospital the day before. This suggestion—as to the source of which I am ignorant—has greatly simplified the aseptic process.

Chemical depilatories have been recommended by some as being quite as efficient as the razor for removing hair, and as having also an antiseptic effect of their own. I have had no actual experience with these agents, except to witness their extraordinary action in removing the hair from the arm and leg. Because of the fact that chemical depilatories, even if they should prove to be unirritating to the skin, are unstable compounds and are practically useless if not fresh, their use in general surgery would appear to have no special advantage over the razor.

Though a perfect sterilization of the skin of the patient —and this applies equally to the hands of the operator and his assistants—is probably impossible under any method, the use of 70 per cent. alcohol * has given very satisfactory results

* This was recommended to me by Dr. Harrington, who proved its value by bacteriological experiments. He declared that, while absolute alcohol has no effect whatever on dried bacteria, alcohol of 70 per cent. is a very satisfactory germicide. It is not claimed that this method is better than any other, but only that it yields equally good results, while it is simple, comparatively unirritating to most skins, and, for hospitals at least, inexpensive. The admixtures required by the United States Government do not detract from its efficiency.

Some time ago Dr. Harrington furnished me with a new mixture—"No. 9," he calls it—which, judging from the bacteriological tests made at the hospital, is strikingly effective in disinfecting the hands. As yet I have had no satisfactory opportunity of testing it clinically, but I am convinced from these experiments that, should it not prove too irritating, it will be of great value, especially in disinfecting the skin of the patient, and may displace even alcohol.

as a routine procedure for the last few months at the Boston City Hospital. After a thorough mechanical cleansing of the operating area, the alcohol (70 per cent.) is allowed to drip upon it for two minutes, the part being gently scrubbed at the same time with a sterile wad of gauze in the sterile hands of an assistant.

*Disinfection of the Hands.**—The use of 70 per cent. alcohol has been found equally satisfactory for disinfecting the hands; this, of course, after a very thorough mechanical cleansing. The details are as follows:

1. The hands are very thoroughly washed in hot water, a bristle brush being used. No time is specified for this process, it being required only that the hands should be thoroughly clean in the ordinary sense, and the skin soft. Obviously, such a process should take longer with some hands than with others.†

2. The hands are thoroughly dried with an ordinary clean towel. During this process a good deal of softened epidermis may be rubbed off. The nails, being now comparatively soft and pliable, may be trimmed with the scissors; and the closer they are trimmed the better. The spaces beneath the extremities of the nails are cleansed by the nail-cleaner, the projecting flesh at the base of the nails is pushed back, and all hang-nails cut off.

3. The hands are washed a second time with soap and hot water.

4. They are washed off with sterile salt solution.

5. They are soaked in 70 per cent. alcohol *for two minutes.* This is the only part of the process where time is specified.

* It is hardly necessary to call attention to the well-known necessity of avoiding contamination of the hands at any time with septic material. Sterile instruments should be used in changing septic dressings, or rubber gloves should be worn.

† The suggestion of Freeman, that the hands should be given a chance to perspire by wearing gloves for a long time before sterilization, or by immersing the gloved hands in hot water, seems an excellent one, but it adds very much to the detail of preparation.

6. The hands are dried on a sterile towel, and they are ready for the gloves.

*Gloves.**—I am aware that some successful surgeons do not use gloves; nevertheless, I am unable to accept this as evidence of absence of danger from the ungloved hand, for what may not be a danger with one man may be so with another. Rubber gloves should be thoroughly washed after operation, and boiled for six minutes. They should then be inspected for punctures. If it is possible to repair them, they should be mended, and then tested again. They should then be powdered, wrapped in cloths, and sterilized in the autoclave for one half-hour at ten pounds' pressure.† Gloves may also be sterilized by simple boiling.

Instruments.—The customary ten minutes' boiling of instruments has been proved to be sufficient, if properly carried out. One source of infection is the neglect of a precaution, well-recognized, but, to my knowledge, not always carried out. It is absolutely essential that instruments which are difficult to clean, and which remain for a long time in close contact with the tissues in a wound, should be taken apart before sterilizing. Hæmostatic forceps, for instance, with their corrugated jaws, are particularly dangerous if not unlocked before being boiled. Cultures taken from the jaws of forceps which had been soiled with pus, the jaws tightly locked, and the instruments boiled for ten minutes, still yielded positive results. When one considers how hæmostatic forceps crush the tissues, and how long they stay in contact with them, it is difficult to imagine a better method of infection in case the jaws are not sterile. No excuse should justify failure on the part of the assistant to satisfy himself that the forceps have been properly sterilized.

* The only method of procedure, which, *if ultimately it prove practicable,* is likely to replace the use of gloves, with the attendant danger of infection from puncture, is covering the hands with an impermeable coating.

† Wandel and Höhne seem to have succeeded in sterilizing them by mechanical cleansing alone; but I do not know that their methods have been put into general practice by others.

Caps and Masks.—The theoretical danger of infection from the head and mouth of the surgeon justify our insisting upon the wearing of caps and masks at aseptic operations—at least, at major operations—until their necessity is disproved. If caps are not worn, the surgeon's hair often comes in contact with that of his assistant, directly over the wound, and particles of dust, dandruff, and bacteria are likely to descend into it. I have good authority for the statement that saliva contains more bacteria, volume for volume, than sewage.* Minute particles of highly infectious material may be expelled from the mouth, and possibly from the nose, during talking, coughing, or sneezing.

The gauze mufflers which are generally used for masks are most uncomfortable to wear during an operation, and, if the surgeon wears glasses, these are apt to be obscured from time to time by his breath which escapes from the muffler just below them. I have found the Vienna masks, made on a wire frame, much more comfortable than the ordinary mufflers.

Solutions.—The tendency nowadays is to dispense with all solutions during an operation, except warm sterilized salt solution for irrigating and washing. Dipping instruments into corrosive solutions, or rinsing the hands for a few seconds, as we see so frequently done, has no antiseptic effect whatever.

(B.) CONDUCT OF AN ASEPTIC OPERATION.

In the conduct of an aseptic operation, the following are essential on the part of all engaged:

* "In addition to the care of the hands, the surgeon should also have washed his face thoroughly; and if he wears a beard or moustache, special heed must be paid to the cleanliness of these. Very little attention is usually paid to the cleansing of the mouth; yet, when it is remembered that the saliva contains a larger number of micro-organisms than the worst sewage, that streptococci and staphylococci are amongst the most numerous of these, and that they are proved to pass into the air in loud talking or coughing, it would appear worth the surgeon's while to take into account a cavity which comes so near the operation wound." Lessons in Disinfection and Sterilization. F. W. Andrewes, Lecturer on Pathology, Pathologist and Sanitary Officer to St. Bartholomew's Hospital, London, 1903, p. 123.

1. Belief in the aseptic idea.
2. Fixed habits of asepsis.
3. Co-operation, or "aseptic team-work."

Assistants should be taught, what the surgeon already knows, that the fewer the hands entering into an operation, the less the wound is touched with the fingers, the less the talking over it, the shorter the time consumed in operating, the less the ligatures are exposed or handled, just so much less is the danger of infection.

The care of the ligatures, as we all know, is one of the most important details of the operation. Unlike instruments, and, therefore, more dangerous, they are put into the wound to stay there; and if bacteria go with them, such bacteria are not so likely to be removed later, during sponging or irrigating, as those introduced in other ways. It is rather unfortunate that the usual way of putting up catgut is to roll it upon a glass reel, for the temptation to straighten it out in the fingers is almost irresistible; in fact, this, to some extent, is necessary, but the process may easily infect it, especially if it has to pass from hand to hand.

Considering the fact that probably few wounds are absolutely germ-free, and also that latent germs in the tissues may be awakened by injury, *assistants should also be taught* the importance of injuring tissues as little as possible by manipulation or too much irrigation; of the necessity of removing blood and stopping hæmorrhage; of leaving a dry wound; of uniting the deeper parts of it by buried stitches, enough room being allowed between them for drainage; and of remembering to apply this same rule to skin sutures, special drainage being used for large wounds, particularly where "dead spaces" exist.

In addition to learning the necessary measures to be taken before and after the operation to diminish the chances of auto-intoxication, *assistants should also know* the importance of strengthening the resisting power of the patient's tissues in every possible way; for the general physical condition of the patient, and possibly the psychical, may often,

so far as asepsis goes, be the determining factors in the case.

All these, and many similar points, should be inherited, as it were, by one assistant from another, and become incorporated into that common knowledge which, especially in a hospital where change is the order of the day, is of more value in keeping up the standard than all else, namely, "hospital tradition."

Many of these precepts *the nurses* should be equally familiar with, and it belongs to those in charge of the training-school to *instruct them* in the theory of asepsis; and to the surgeon or his assistants, but especially to the head nurse in charge of the operating floor,—a person who is usually selected for her general efficiency in surgical work,—to see that they are made familiar with the proper practice of it.

SUMMARY OF MINIMUM REQUIREMENTS FOR ASEPTIC WORK, AS GIVEN IN THIS PAPER.

1. Materials to be sterilized in saturated steam in the autoclave, for one half-hour, under fifteen pounds' pressure; rubber gloves and salt solution under ten pounds' pressure. If there is not sufficient space in the autoclave for the gauze dressings they may be baked.

2. In hospitals without proper facilities for sterilization of absorbable ligatures, these to be obtained from reliable dealers whose business reputation is at stake.

3. An operating room which can be easily cleaned, and *which is cleaned,* where the air is kept as free from dust as possible, where draughts are minimized, and where formalin fumigation is thoroughly and systematically practised.

4. A hot bath for the patient, and a cleansing and shaving of operating area the night before operation if possible (as an extra precaution). Just before operation, a second cleansing, and sterilization with 70 per cent. alcohol or some equally efficient method.

5. Thorough mechanical cleansing of the hands, and sterilization by 70 per cent. alcohol or some method equally efficient.

6. Ten minutes' boiling for instruments, special attention being paid to taking apart clamps and hæmostatic forceps, or at least unlocking them.

7. Caps, masks, and sterile gloves always to be worn, at least on major cases.

8. Warm sterile salt solution for irrigation and washing.

9. Belief in the aseptic idea, fixed aseptic habits, and aseptic co-operation, on the part of all engaged in an operation.

10. Instruction of assistants and nurses as above set forth.

SOME STUDIES IN ASEPSIS.[1]

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OCCASIONAL visits to operating rooms have impressed me with the fact that, to some extent, surgeons are inclined to overestimate the importance of small possible dangers, and to take more or less for granted absolute immunity from some others of greater magnitude. It was the unquestioning faith which some have shown in the instantaneous germicidal power of corrosive sublimate and other chemicals that gave me my first active interest in the general subject of asepsis and infection; and investigation of the actual value of a large number of these substances led me to consider other matters connected with operative work, including the danger of aerial infection, the sterilization of dressings and sponges, and the disinfection of the skin of the field of operation and of the surgeon's hands.

I shall never forget the look of utter consternation on the faces of all concerned when, one day, during an operation for hernia, I placed a sterile Petri dish upon a spot on the instrument table, about eight inches away from anything lying thereon, in the belief that the surgeon, by whose invitation I was to make certain observations, had arranged for the same with his colleagues. One would have supposed that that innocent dish was a seething mass of infection, fully prepared to disseminate the germs of septicæmia in all directions, even as a pinwheel throws its sparks. A hurried consultation was held, while I made my excuses and attempted to explain the absence of real danger. The result was the covering of that

[1] Read before the American Surgical Association at St. Louis, June 14, 1904.

end of the table and the dish with a sterile towel. At this stage of the case, my culpable partner entered and explained matters, whereupon the towel was removed, the culture medium in the dish was exposed, and the operation proceeded. At the close of the operation, the dish was removed and incubated. The result demonstrated that upon each square inch of the dish and, inferentially, of the table and of the instruments thereon, and presumably of the field of operation, no less than 120 organisms, chiefly pus cocci, were deposited from the air in the course of an hour. It is not for me to say how much danger may reside in such a shower of bacteria. Frankly, I do not know, nor does there seem to be any unanimity of opinion on the part of those who have investigated the question of aerial infection; but it seems to me that the subject is not generally considered to be of such importance as the possibility of infection from sweat or from the introduction of an occasional bacterium from the superficial or deeper layers of the skin or from other sources. It has seemed to me that the danger of infection through the escape of droplets of sweat of a carefully prepared hand through an accidental puncture of a rubber glove is accorded undue weight. I have read numerous reports of experiments concerning the infectivity of sweat, and most of them have impressed me as unwarranted in their conclusions, owing to faulty premises and technique. In a recent article on the subject, it is dogmatically asserted, "The purest of sweat is impure; it is never sterile." With that statement I take issue. Six different times in my laboratory, sweat has been made to flow from well-cleaned, and so far as is possible, sterilized forearms and hands, encased in sterile glass cylinders heated by appropriate means; and in not a single instance could a bacterial growth be obtained. Moreover, injections thereof in fairly large amounts into animals—subcutaneously, intravenously, and intraperitoneally—were quite devoid of results. That there are bacteria in the various layers of the skin and in the hair-follicles there can be no doubt; but that they exist in the sweat-glands, from which the outflow of secretion would tend

to bar them, is by no means clear. Indeed, I am informed by a number of our leading pathologists that an infection starting in a sweat-gland is exceedingly rare.

Of far greater importance, it seems to me, is the danger of infection through saliva. Repeatedly have I seen surgeons, even in abdominal cases, talking directly into the wound. It has been demonstrated by Flügge, of Breslau, and by several others, that in ordinary conversation there is a constant throwing out of minute droplets of saliva, some of which are projected laterally several feet. They are expelled in great numbers in the use of words or syllables beginning with the consonants *d*, *k*, *p*, and *t*, the formation of which involves the sudden explosive liberation of air held in the mouth under pressure. They may be sent forth as numerously during whispering as with loud speech. Now, the mouth cavity is a singularly unclean place, for the secretions of the mouth are likely to be richer in bacteria than the foulest sewage, and these bacteria are largely staphylococci, diplococci, and streptococci, and are likely to be exceedingly virulent. In one series of experiments, recently published, the average number of organisms per droplet of saliva as cast out in ordinary speech proved to be no less than 4375. Is not, then, the danger of infection by this means entitled to greater consideration than that more or less imaginary one of infection through sweat?

That the deeper layers of the skin yield bacteria is a well-known fact, but the mere obtaining of positive results from inoculating culture media therewith is no proof of their harmful nature. Indeed, several of the species commonly present are known to be non-pathogenic.

In speaking of these several matters, I have no intention of advocating any lessening of the precautions taken to bring the danger of infecting the wound to a minimum, but I wish to point out the inconsistency of paying so great an amount of attention to the possibility of introducing bacteria, many of them harmless, from one source and another, and neglecting that of the introduction of others, perhaps more dangerous,

that are showered down through the air and projected from the mouth. I have made numerous exposures of Petri dishes to the air of operating rooms, and in every instance the great majority of the colonies produced have been of pyogenic organisms. The numbers deposited have varied widely, the maximum being 131 per square inch per hour.

In his work in the operating room, the surgeon is dependent to a great extent upon the care and thoroughness with which others, whose work he necessarily cannot supervise in every detail, carry out their part. He must assume that the dressings and sponges have been prepared with scrupulous care. He is, in a way, at the mercy of those in subordinate positions, whose carelessness or want of proper instruction may vitiate his best endeavors. To emphasize this point, I will give two illustrations:

The sterilizing plant of a hospital is to me always an attraction, and whenever I visit one I inquire into the methods followed. I was present one day in a room fitted with as perfect a lot of apparatus as one could wish to see. The person in charge had packed one of the autoclaves with dressings, which were wedged in so tightly that one could find hardly a space between them large enough to admit even a finger. On my asking what measure of sterility was expected with such solid packing, I was informed that absolute sterility would be attained in an hour, the steam being under fifteen pounds' pressure. Anybody who has ever studied steam disinfection scientifically is aware of the great necessity of loose arrangement of the objects under treatment, in order that the steam shall have as free access as possible to every part, and that the readiest means of preventing its action is solid packing.

In an autoclave in another institution, I saw a number of sponge-jars with their lids in place. I ventured to open one of them, and found that the cover fitted so tightly that some little force was necessary for its removal. I asked the attendant if the sponges therein contained were to be sterilized by steam or by dry heat, and the answer was "steam;" but it was obvious that the steam could not gain access to the

interior of the jar, from which, moreover, the contained air could not escape. I received permission to test the matter practically. The contents of the jar were replaced by a number of sponges, which I infected with a twenty-four hours' old culture of *Staphylococcus pyogenes aureus.* The cover was then put on and the whole was subjected to the routine process. Cultures of the sponges were afterwards made in sterile bouillon and incubated for twenty-four hours at 37° C. The results were positive; sterilization had not been effected.

On the other hand, in some hospitals, the sterilization of dressings and sponges is carried to an unnecessary degree of thoroughness, which involves wasting much valuable time. I refer to fractional sterilization. Fractional sterilization of such materials as milk and culture media is necessary, on account of the presence of sporing organisms in a fluid rich in nutriment. The ordinary temperatures employed destroy the bacteria, but the spores resist; during the next twenty-four hours these develop into bacteria, which are destroyed by a second heating; and a third treatment insures sterility beyond a doubt. These spores, by the way, are those of certain non-pathogenic organisms; the most resistant pathogenic spores are killed by a few minutes' boiling. But in the case of dressings treated properly with steam under pressure, both the bacteria and the spores present are destroyed with one exposure, for even the very resistant non-pathogenic spores above mentioned cannot resist steam under fifteen pounds' pressure for ten minutes. But supposing they could, what effect would a second treatment on the following day have upon them? *None whatever,* for in the absence of moisture and nutrient material they could not develop into bacilli, and so long as they remained spores they would, within reasonable limits, retain their resistance. So a second exposure would be as futile as the first, and a third, fourth, and fifth would be equally barren of results.

Carried out with proper precautions as to packing and vacuum formation, sterilization of dressings and sponges requires but one exposure to steam under fifteen pounds' press-

ure for thirty minutes at most. Indeed, I have placed dried cultures of *Staphylococcus aureus* and *Staphylococcus albus* in the pockets and sleeves of two coats rolled loosely together, and have attained sterility in ten minutes with steam under ten pounds' pressure.

The preparation of the hands for surgical work is a subject that has interested me greatly. The potassium permanganate oxalic acid portion of the process has always excited my wonder. Three explanations have been given me of the necessity or advisability of this treatment, namely, 1. That the permanganate destroys bacteria; 2. That it oxidizes the organic matters adherent to the skin; 3. That when one stains the hands in every part with permanganate and then removes the stain with oxalic acid, the hands are clean. As to the assertion that it destroys bacteria: I have experimented with saturated permanganate solution against *Staphylococcus aureus* and *albus, Bacillus coli,* and *Bacillus pyocyaneus,* and have found that ten minutes' exposure is ineffective against all but the last mentioned. These results were obtained not once, but several times. As to the oxidation of organic matter: Potassium permanganate is pre-eminently an oxidizer of organic matter. On dipping the hands into a saturated solution, they are stained a deep brown, owing to the precipitation of a lower oxide, oxygen having been given up to the epidermal scales and other organic matter. This deposit of the lower oxide is soluble in oxalic acid, which thus restores the normal color of the hands. It is assumed that the organic matter (just what harm it will do, unless it is in the form of bacteria, I do not know) is completely oxidized and disposed of. Dip the hands, however, a second time, and see what happens. The same thing. Repeat it. Again it happens, and again, and again, and again. This is due to the fact that, immediately on contact with organic matter, the permanganate is reduced and the hands become, as it were, *plated* with the precipitated lower oxide, which acts as a bar to further action of the permanganate upon the parts immediately beneath the plating, just as the albuminate of mercury prevents the further

action of corrosive sublimate. A short time ago, I tried the experiment of treating my hands first with permanganate and then with oxalic acid and repeating the process until further treatment failed to give the characteristic brown stain. On the twenty-first trial, the stain was observed to be less intense, and so on to the twenty-fifth, when the experiment was discontinued. From this it would appear that to oxidize all the organic matter possible by this means is an endless task. After twenty-five treatments, I washed my hands with soap and water, and after repeated rinsing in running water, I dipped them again into the permanganate solution. At once the original dark-brown stain appeared as intensely as ever; I was then oxidizing the traces of soap, which, in spite of continued rinsing, adheres tenaciously to the skin, as is proved by the great difficulty one observes in removing, by rinsing, the odor of a scented soap after washing therewith.

As to the statement that a hand once stained and decolorized is necessarily clean, there is but little to say. A dirty hand may be stained and decolorized as well as a clean one, but the dirt remains. Permanganate removes no dirt and destroys only weakly resistant bacteria.

After thorough brushing with hot soapsuds, what agent can be relied upon to kill the bacteria that have not been removed? Not corrosive sublimate 1–1000, if we soak the hands a quarter of an hour; not creolin 1–20, if we soak them much longer; not lysol, nor solveol, nor bacillol, nor sulphonaphtol; not peroxide of hydrogen; not sublamin; not mercuric cyanide; not even formaldehyde in 5 per cent. solution, even though the skin could stand it. All of these agents and several others I have tested under the most favorable conditions against the common pus organisms and all failed to kill within reasonable periods. Without going unnecessarily into details, I will give my results as briefly as possible. A little more than a year ago, I published the results of a series of experiments which demonstrated, among other things, that corrosive sublimate, 1–1000, requires more than ten minutes' contact to kill *Staphylococcus albus,* and that weaker solutions (1–5000)

act far more slowly. Recently I tried 1–500, which solution is too strong and irritating for general application, and found that it would kill *Staphylococcus aureus* in from sixty to ninety seconds and the other pyogenic organisms in from forty to sixty seconds. With 1–100, I found that the aureus was killed after twenty seconds. Now, if 1–100 cannot destroy pus cocci in twenty seconds, and 1–500 can do so only after a minute, and 1–1000 only after ten minutes, what measure of disinfection does the surgeon attain who merely dips his hands into the solutions of corrosive sublimate in common use for only a few seconds and then rinses them off with sterile water or salt solution?

In my tests of the germicidal power of other disinfectant solutions, I employed a number of different species of bacteria; but in the brief report of results now to be made, I will deal only with that pyogenic organism which is the most common and also the most resistant,—*Staphylococcus pyogenes aureus.*

The following table shows the number of minutes that the organism mentioned remained in contact with the several disinfectants without injury, and also the shortest exposure observed that was sufficient for its destruction. The intervals adopted were as follows: Thirty seconds, 1, 2, 3, 4, 5, 7, 10, 15, 30, 45, and 60 minutes. In only one case was the exposure longer than sixty minutes, and then the agent failed to kill in three hours.

Agent.	Strength.	Failed to Kill. (Minutes.)	Killed. (Minutes.)
Carbolic acid	1–40	3	4
" "	1–20	1	2
Trikresol	1–40	2	3
"	1–20	1	2
Lysol	1–40	7	10
"	1–20	2	3
Solveol	1–40	10	15
"	1–20	10	15
Bacillol	1–40	4	5
"	1–20	3	4
Creolin	1–40	10	15
"	1–20	10	15
Sulphonaphtol	1–20	30	45
Hydrogen peroxide	Full strength	4	5

Agent.	Strength.	Failed to Kill. (Minutes.)	Killed. (Minutes.)
Formaldehyde	1 per cent.	60	. .
"	2 per cent.	30	45
"	3 per cent.	25	30
"	5 per cent.	15	20
Mercuric cyanide	1–1000	180	. .
Sublamin	1–1000	10	. .
Potassium permanganate .	Saturated	10	15
Potassium permanganate and hydrochloric acid (Audrewes)	1 per cent. each	4	5

Here, then, are twenty-two preparations, not one of which acts under two minutes, and most of them only after five.

My next endeavor was to find some preparation that will kill not in minutes, but in seconds. It was obvious that none of the organic compounds mentioned could be depended upon to do this in any strength which it would be practicable to use, and I had, therefore, to turn to the inorganic agents. Of the salts of the metals, corrosive sublimate is beyond question the most powerful, but this cannot be depended upon in its usual solutions, as I have already pointed out; and hence it must be combined with some other agent or agents, if any increase in effectiveness is to be secured. The addition of hydrochloric acid to the extent of 10 per cent. was found to be very effective, but a solution of an irritant like corrosive sublimate with another like hydrochloric acid would obviously be out of the question, on account of its local action; but if this action could be prevented, the combination might be useful. First, I experimented with a mixture which I found would kill *Staphylococcus aureus*, *albus*, and *citreus* and *Bacillus pyocyaneus* in less than ten seconds. Then I tried weakening it, first as to one, then as to another ingredient, but always aiming to keep its limit of required time at about ten seconds. The ninth combination tried appeared to be as weak with respect to each of the active constituents as could be made, retaining that degree of efficiency—that is, to kill the pyogenic bacteria on silk threads, not in the skin—within ten seconds. I tried it against pus from a carbuncle and against two other specimens of uncertain origin, and at the same time I tried

carbolic acid and trikresol, which had proved to be the quickest in action of the twenty-two solutions above mentioned. Let me say here, that killing bacteria in pus is quite a different thing from killing them on threads and glass beads.

The carbuncle pus was killed by trikresol (1–40) in five and a half minutes and by carbolic acid (1–40) in four; my mixture killed it in less than a minute, though not in thirty seconds. The other specimens of pus were both killed by trikresol and carbolic in two minutes, and by my mixture in less than thirty seconds.

Following are the results of attempts to sterilize the skin. I have repeatedly soaked my hand (without any preliminary scrubbing) for two minutes, and then have had plantings made from material removed from about each nail and from scrapings from the skin of each finger and from the palm. Occasionally, I got a growth; but, as a rule, every tube of bouillon remained clean and sterile. A young man, whose duties included the daily cleaning of cages in the animal room and whose hands were not the subject of much thought or care, soaked his hand (after ordinary washing) on ten different occasions for from two to five minutes; and each time each nail and finger was tested, *i.e.*, ten cultures were made. In seven of the experiments there was entire absence of growths; in one, a growth was obtained from one forefinger; in one, from one middle finger; and in one, from one thumb. That is to say, of 100 plantings only three showed growths.

At the Boston City Hospital, Dr. Monks immersed his hands for two minutes without previous scrubbing; the skin of both hands gave negative results, but growths were obtained from the nails of the right hand; the nails of the left hand were sterile. Three of the assistants did the same thing, but after scrubbing, and with these results:

Dr. H. Left hand sterile; nails gave growth.
Right hand sterile; nails sterile.
Dr. K. Left hand sterile; nails sterile.
Right hand sterile; nails sterile.
Dr. S. Left hand sterile; nails sterile.
Right hand sterile; nails sterile.

Examination of the skin of Drs. H. and K. after being engaged in operating showed persistent sterility; but Dr. S.'s left hand yielded a growth. The mixture has been used also in several cases of lacerated wounds.

For my combination, I make no claims whatever, and no assertions that later might have to be recalled. I submit the facts as I have seen them. I do not say that everybody will get the same results that I have seen. To my hands and to those of my assistants, the mixture has caused no irritation beyond the same degree of biting that one notices when in contact with peroxide of hydrogen. Two of the surgical assistants reported slight exfoliation two days after trying it, but nothing more. I recognize that some skins may be more markedly irritated, and that not sufficiently numerous experiments have been made to warrant unqualified recommendation.

The composition of the mixture is as follows:

Commercial alcohol (94 per cent.)	640 cubic centimetres.
Hydrochloric acid	60 cubic centimetres.
Water	300 cubic centimetres.
Corrosive sublimate	0.8 gramme

This mixture, then, contains 60 per cent. absolute alcohol, 6 per cent. commercial (strong) hydrochloric acid, and 1–1250 corrosive sublimate. Now, 60 per cent. alcohol will destroy *Staphylococcus aureus* in four minutes; 10 per cent. hydrochloric acid is equally effective; and 1–1000 corrosive sublimate will kill it in three minutes. Why a combination containing all three substances, but with lesser proportions of the acid and the salt, is so much quicker in its action than any one of them alone, is an interesting question of physical chemistry.

AN ADENOMA OF SEBACEOUS GLANDS OF THE ABDOMINAL WALL.[1]

WITH A REVIEW OF THE LITERATURE OF ADENOMA AND HYPERPLASIA OF THE SEBACEOUS GLANDS.

BY WILLIAM COGSWELL CLARKE, M.D.,

OF NEW YORK.

THIS tumor is of surgical and pathological interest both from its extreme rarity and from the difficulty of diagnosis. Dr. Emil Bock, in 1880, probably gave the first good description of a real adenoma of sebaceous glands, accompanied by drawings of microscopic sections. Many writers have described hyperplasia of the glands and also primary lesions of the skin where the glands have become secondarily involved, and called them "Adenomata Sebacea." But if one takes into consideration the classification of Unna, which is quoted in the latter part of this article, the difference is manifest.

Present Case.—In July, 1903, a Jewess, eleven years of age, was referred from the Medical to the Surgical Class of the Out-Patient Department of the Roosevelt Hospital, for the removal of a tumor of the abdominal wall.

Past History.—She had always been in good health and had never received an injury of any kind. Menstruation had not commenced, although pubic and axillary hair was fully grown and her breasts were well developed.

Present History.—Three years ago she noticed in the skin a tumor about the size of a pea, situated three centimetres above and five centimetres to the left of the umbilicus. It lay in a line drawn from the nipple downward and slightly inward. Both she and her mother were positive that the growth had not always been present, and also that from the time of its first appearance it had

[1] A study from the Department of Pathology of the College of Physicians and Surgeons (Columbia University), New York.

slowly increased in size, at the same time becoming dark in color. Three months ago it suddenly began to grow more rapidly. There had never been any pain or unpleasant sensation connected with it, and she had not lost flesh or strength.

Physical Examination.—Inspection. The patient was well nourished, apparently in perfect health, large and strong for her years. No growths were seen on any other part of the body. The tumor was oval, smooth, and prominent, about six centimetres by five centimetres in diameter, bulging forward three centimetres. There was some wrinkling of the skin at the angle where it turned to pass over the tumor. On the dome of the growth for an area of three centimetres, the skin was thin, smooth, and dark, on account of the presence of many enlarged blood-vessels.

Palpation.—The tumor was a soft, fluctuating mass apparently made up of two cysts, one considerably larger than the other. It was intimately adherent to the deeper layers of the skin. The superficial layers of the latter were movable over the growth, showing not even the slightest point of attachment. The growth was freely movable on the deeper parts; the abdominal muscles put upon the stretch did not at all limit its mobility.

Operation.—Ether anæsthesia. An elliptical incision surrounding the tumor and exposing its base allowed an easy dissection of the tumor from its bed in the fat of the subcutaneous tissue of the abdominal wall. After its removal, a certain amount of fat and subcutaneous tissue still remained undisturbed, overlying the abdominal muscles. The wound was readily closed by three deep catgut sutures, and by black silk for the skin. The wound healed by primary union and the sutures were removed on the eighth day.

Morphological Examination.—Macroscopic. The material consisted of seven cysts, which composed about four-fifths of the tumor, and the balance was an irregular wedge-shaped mass of firm tissue situated between the two largest cysts. The average size of the cysts was about two centimetres in diameter,—the largest, four centimetres; the smallest, three millimetres. Five of these cysts contained a thin, watery, dark-brown fluid, while the smallest (Plate I, P) was filled with a dark, firm, sebaceous material. The true skin was not attached to the surface of any of the cysts, although the mass was indirectly adherent to the skin because of its situation in the subcutaneous connective tissue.

Microscopic Examination.—Two-fifths of the firm tissue was stroma and the balance epithelial masses and small cysts. The stroma consisted of rather dense connective tissue in bands, whose fibres were arranged in parallel rows. These bands ran between the epithelial alveoli and at times in the alveoli, acting as trabeculæ. In places, the connective-tissue bands, especially some of the connective-tissue trabeculæ found in the alveoli, had undergone hyalin degeneration. Blood-vessels were scanty throughout the stroma. The adventitia of the vessel walls was somewhat thickened. The endothelial cells of the intima were markedly swollen and in places increased in number. Sweat-glands were present, and both the stroma and epithelium were normal in appearance.

Epithelial Cells.—The epithelial cells were arranged in cylinders and oval masses, sections of which in places were much elongated, in others, round or oval (Plates I and II). The width of the alveoli on an average ran from 75 to 800 microns, the majority being about 500 microns. The cells in the alveoli were arranged for the most part in a number of small nests, each consisting of from twenty to thirty cells, concentrically placed. Towards the outside of an alveolus the cells were arranged in rows parallel to its boundary. This regular arrangement of cells was especially marked in the outermost row. It is worthy of note that in no instance was there an extension of the epithelial cells into the stroma itself, but they were massed together and surrounded by a firm band of connective tissue. The cells themselves were of large size, cuboidal, polyhedral, columnar, or even in places cylindrical in shape. The most regular and symmetrical measured from thirty to thirty-five micromillimetres in diameter. The cell-body stained easily with eosin, taking on a fairly deep color, and appeared faintly granular. The nucleus was large and oval, occupying about one-third of the cell-body. It stained very readily with hæmatoxylin, showing many rather coarse, deeply stained granules. A nucleolus was seen in each nucleus. No mitotic figures were observed in the cells of any of the sections. Spine or so-called " prickle cells" could not be found.

Cell Degeneration.—Scattered here and there, usually towards the centre of the alveoli, or else in the epithelial layers of the cyst walls, were many isolated cells which stained deep purple, both with hæmatoxylin-eosin and picro-acid-fuchsin (Plate III, A).

PLATE I.

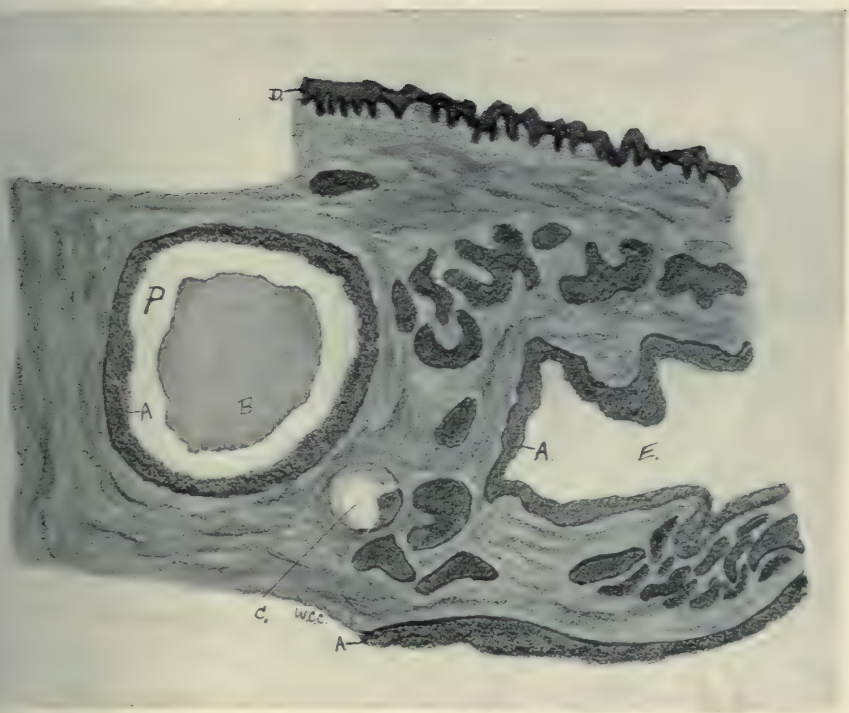


PLATE II.

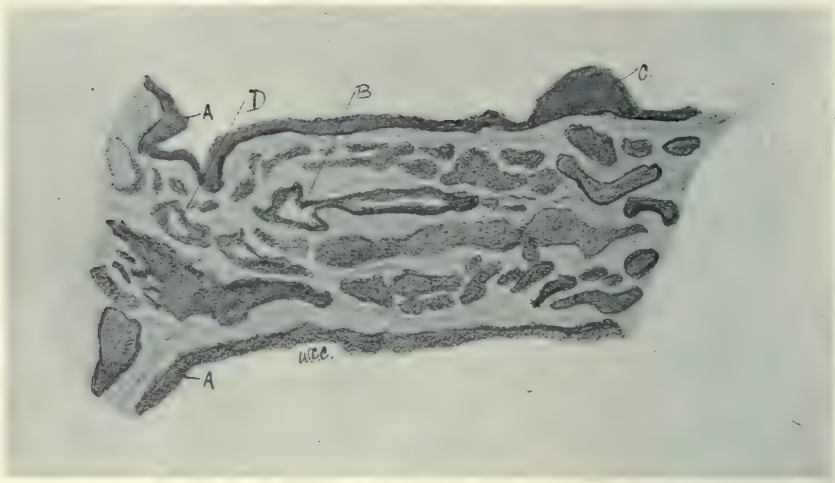


PLATE III.

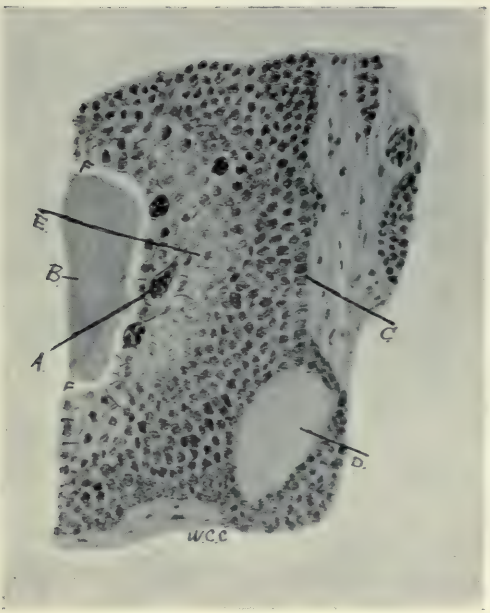
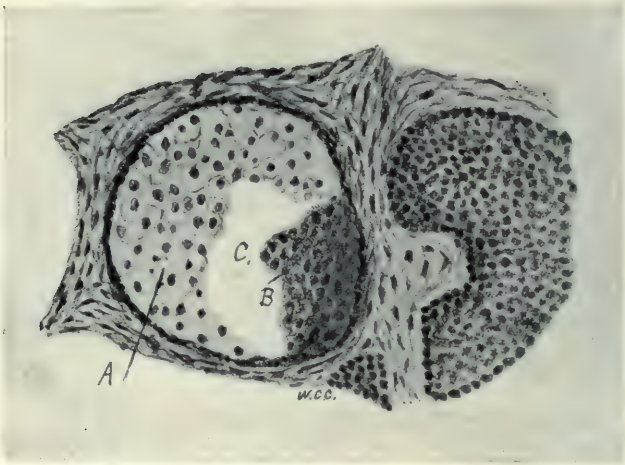


PLATE IV.



The cell-bodies, staining purple, were often elongated, either homogeneous or vacuolated, with no nuclei showing; apparently mucous degeneration of the epithelial cells. Besides the above cells, some alveoli contained an area whose cells were large, measuring forty-three micromillimetres in diameter, and vesicular in shape. The cell-body did not stain with either hæmatoxylin-eosin or picro-acid-fuchsin. It was occupied by fine vacuoles, very regular in shape. Occasionally larger vacuoles were seen. The cell-wall was thin, sharply outlined, at times broken down as though the cells had ruptured. This condition was most often observed towards the centre of the alveoli. The nucleus was round and measured eight and six-tenths micromillimetres in diameter. It was situated in some near the centre of the cell, in others near the cell-wall. After staining, the color of the nucleus was a rather faint homogeneous blue, not granular (Plate IV, A).

Cysts—Walls and Contents.—In addition to the seven cysts whose gross appearance has already been described, many others were noted in the microscopic examination, measuring from 160 to 640 microns in diameter. They were for the most part round, at times oval, or very much elongated. The walls of the cysts varied considerably. At times, when the cyst was situated in the centre of an alveolus, the limiting walls were sharp and clean-cut, and the epithelial cells were even and regular in shape, no degenerated or ruptured cells appearing (Plate II, D). Again, especially in the larger cysts, the walls were made up of fifteen to twenty-five layers of epithelial cells, the innermost of them being broken and disintegrated (Plate I and Plate II at A, A, A, A). Here and there appeared the cells mentioned above as undergoing mucous degeneration. Some of the small cysts also had uneven walls, a few of them bounded by the large, clear staining cells undergoing fatty metamorphosis (Plate IV, C), others by jagged walls in which were many cells undergoing mucous degeneration (Plate III, F, F). The contents of some of the smaller cysts, when not dissolved while fixing and hardening the specimen, stained a deep purple color, and invariably there were noted in the walls cells which were undergoing the so-called mucous degeneration (Plate III, B). In other cysts the material stained a deep pink, granular or vacuolated in appearance (Plate I, B). In this material, especially towards the edge, many cholesterin crystals together with groups of cells and isolated cells resembling those

undergoing fatty metamorphosis were noted; also a few nuclei, which stained a pale blue, the cell-body apparently having disintegrated.

In addition to the above cysts, a few openings similar to gland ducts were seen. One opening branched twice, and these branches also divided, resembling a compound tubular gland (Plate V, A). This duct-like arrangement existed in several serial sections, demonstrating that the lumen was of considerable size. The walls, which were sharp and clean-cut in outline, consisted in every case of a number of layers of epithelial cells, not like the ragged walls of the cysts described above.

The Skin covering the Tumor.—The epithelial layers were normal, except that at the summit of the tumor the papillæ of the true skin had all been much shortened and the spaces between the papillæ widened. Between the epithelial layers of the skin and the epithelium of the tumor there was a band of connective tissue, the pars papillaris and pars reticularis of the true skin.

Diagnosis of Present Case.—An epithelial cystic growth of this nature, with cells undergoing fatty changes, could have originated from any one of the following: (A) The glands in the wall of a dermoid cyst; (B) the epithelium of an inclusion cyst; (C) a supernumerary mammary gland; (D) the sweat-glands; or (E) the sebaceous glands of the normal skin.

(A) The first of the above possibilities is ruled out by the fact that no hair-follicles or other remains of the wall of a dermoid cyst existed, such as stratified squamous epithelium, spine, or prickle cells.

(B) The presence of compound gland ducts, the absence of stratified epithelium, and the large size of the epithelial cells, discredit the growth as having originated from the wall of an inclusion or epidermoid cyst; also, there are no glands found in the walls of inclusion cysts from which an adenoma might spring.

(C) The tumor could not have originated from a supernumerary mammary gland, since it did not have any of the characteristics of such a growth.

PLATE V.



(D) The fourth possibility, that the tumor originated from a sweat-gland, can be easily ruled out because in the present tumor the epithelial cell-body did not stain as deeply as sudoriparous cells; and the gland-ducts were compound and thick walled, whereas in tumors growing from sweat-glands the ducts do not usually branch and their walls are lined by only one or two layers of cells. Klauber [1] has recently described sweat-gland adenomata in which there were many small cysts and gland tubules, whose walls consisted of a thin layer of epithelial cells.

(E) Therefore, having eliminated the four preceding possibilities, the existence of a pathological development of the infundibula of sebaceous glands remains for consideration. In this connection, attention is called to the deep situation of the tumor and its apparent separation from the skin; to the complex alveolar arrangement; to the formation of compound ducts; to the sparseness of ducts in a given section; to the formation of sebaceous material in one of the cysts, probably from cells in the wall, more like cells found in the normal sebaceous glands undergoing fatty metamorphosis; to the absence of laminated material such as is found in cysts formed from cells, which ultimately would have produced pavement or stratified squamous epithelium; and to the large size of the cells in the alveoli similar to sebaceous cells, and not like cells of the epidermis, except the basal cells, which are similar in character and continuous with the germ or basal cells of sebaceous glands.

RÉSUMÉ OF THE LITERATURE OF TRUE ADENOMATA OF SEBACEOUS GLANDS.

Bock,[2] in 1880, gave an exceedingly good description of the condition. In speaking of adenomata of sebaceous glands, he said the literature was very scanty. He mentioned Schmidt's *Jahrbücher,* in which there is an article by Porta [3] on tumors of sebaceous follicles. The date of this article is 1856; in it there is given a list and the situation of 384 tumors; 238 were cystic, twenty-six of them being sebaceous. No detailed

microscopic description was given. Bock also mentions Förster's "Handbuch der Allgemeine pathologische Anatomie," S. 179, as referring to hypertrophy of sweat and sebaceous glands in contradistinction to that of sebaceous gland tumors. Bock further quotes Rindfleisch, "Lehrbuch der pathologische Geweblehre," S. 288, as describing a case of pure hypertrophy of a sebaceous gland tumor which had a broad base covered by the hairy scalp. The tumor was the size of a pigeon's egg, and its structure resembled that of a mammary gland. Birch Hirschfeld is also mentioned as citing the preceding case, and considers the true hypertrophy of sebaceous glands as probably very rare.

Bock's own specimen was eight centimetres in length, six centimetres in breadth, and three and five-tenths centimetres in height. Cut sections showed many epithelial alveoli separated by connective-tissue bands. The skin was apparently normal, except in places the papillæ were somewhat elongated. The lobules of the tumor had diameters of from one to six millimetres and were either round or elongated. In the gland substance were openings, microscopic in size, some cut squarely across, others obliquely. In places he found the centre of the lobules filled with cells undergoing fatty degeneration, with fat drops and granular masses. Towards the centre of the alveoli the cells were larger, appearing always epidermic in character and dimmed with fat; these changes in the cells were the causes of the construction of fat drops and granular masses in many acini. The sweat-glands were normal and regular. He gives a drawing showing the general topography of the epithelial alveoli with the central openings and with the normal condition of the skin covering the tumor; also a drawing of one-half of an alveolus, showing the outside cells clear and regular in arrangement, with fat drops increasing in number towards the centre of the alveolus, which is filled with a homogeneous mass.

Eve,[4] in 1881, gave a good description of a partly cystic and partly adenomatous tumor which had become calcified. His plate certainly shows the lobules of an adenoma. The tumor measured one and one-quarter by one-half inches. It was seen to consist of columns, made up of epithelial cells, which presented every variety of size, from minute round masses of cells, one-fortieth of an inch in diameter, to large columns or cylinders one-half to three-quarters of an inch in diameter, having the appearance of alveoli in transverse section. In the sections the alveoli were cut across in various directions and were round or oval; the smaller columns were in places irregular, tortuous, branched, and occasionally uniting. The cells were small, round or oval, closely packed together without intercellular substance. Occupying a position near the centre of many

of the larger columns, and in a few instances of the smaller, unstained granular masses were observed, which were probably the seats of the calcareous matter. This material was found, on further examination, to consist largely of fatty matter containing crystals of cholesterin, and may be regarded as an attempt at the formation of sebum by the gland tissue. Eve thinks it may be regarded as an adenoma associated with the sebaceous glands.

Krauss,[6] in 1884, in an article concerning giant cells in epithelial growths, mentions an adenoma of sebaceous glands, a tumor, 2.9 centimetres by 2.5 by 1.7 centimetres, on the left arm of a man twenty years of age. This fairly solid tumor was soft and contained a doughy mass in the centre. The skin was quite thin and separate from the growth, a firm connective-tissue capsule enclosing it. The epithelium was arranged in lobules, round or oval in shape, at times tubular. The centres of the lobules and tubules were filled with a firm necrotic mass from degenerating cells. A cut is given showing several alveoli with centres filled with the necrotic masses. He mentions sweat-glands as if they had no connection with the tumor.

Poncet,[6] in 1890, described a case of a man of fifty-three years of age, who, for thirty years or more, had over sixty tumors on his head alone. A cut is given showing a man's head covered with large-sized, closely set tumors; a very prominent one is seen on his forehead. Microscopic examination of one of these tumors by Band showed it to be made up of round lobules separated by connective-tissue bands. The lobules are composed of epithelial cells. The cells have the same characteristics as young sebaceous gland cells. The peripheral cells of the lobules are in regular rows. In the centre of most of the lobules there is an unstained part, light gray or colorless; this part looks like a sebaceous mass. He concludes that it is a tumor made up of epithelial cells similar to sebaceous gland cells.

Jarisch [7] gives a few cases of skin tumors, with many good cuts, and also reviews the literature of sebaceous adenoma.

Richard Barlow,[8] in 1895, reviewed the whole subject thoroughly. He describes a case of multiple tumors of the scalp, of six years' duration, in a person sixty years of age, and calls it a case of adenomata of the sebaceous glands. He speaks of the definition of adenoma, and quotes Förster, Cohnheim, Ziegler, and others. He also speaks of the different types of lesions of these glands. In conclusion, he says an adenoma may occur in sebaceous glands, may become calcified, and also may become cancerous. He gives several plates of adenoma of sebaceous glands of the scalp.

Curtis and Lambret,[9] in 1900, review the subject up to

date, and describe a large tumor of eight years' growth, which clinically was thought to be malignant; histologically it was thought to be a simple adenoma of the sebaceous glands and similar to Bock's, Monti's, and others.

Borst[10] in his book on tumors shows a picture of a sebaceous adenoma which was made up of lobules of epithelial cells separated by bands of connective tissue. The lobules are very irregular in shape, their centres occupied by masses of sebaceous material. He says that a pure adenoma of sebaceous glands, either a solitary, nodular, fleshy, or sometimes ulcerated, encapsulated tumor, may exist, which is made up of epithelial lobules, the centres of which are filled with fatty masses. The connective tissue and vessel walls may undergo hyaline degeneration; also, in an adenoma the peripheral germ cell layers, which shut in or enclose the epithelial cells of the follicle, spread out, while the old central layers of cells are mostly overwhelmed by fat infiltration, and, in consequence, they are not of a typical form, so that the enclosed fat mass in the centre grows from the rupture of these cell-bodies.

Krompecher,[11] in 1903, mentions the relation that may exist between the basal cells of hair-follicles, or of sweat or sebaceous glands, and flat-celled cancers, also the similarity of structure of sebaceous glands to breast glands; and gives a diagram of different types of sebaceous gland hypertrophy, showing how different types of tumors may develop from the different epithelial layers of the skin.

Levings,[12] in 1903, speaks of adenomata of sebaceous and sudoriparous glands. "These growths are of rare occurrence. When taking origin from the sebaceous glands they are closely adherent to the skin, are round or slightly lobulated, elastic, and reasonably hard growths. They are made up of an aggregation of alveoli, and are to be differentiated from the ordinary wen and from the tumors which are entirely subcutaneous. In size they are usually small, often not exceeding that of a hickory-nut, but in exceptional cases they have become quite large."

Ribbert[13] mentions adenoma of the sebaceous glands and speaks of Barlow's article.

Unna's[14] *Review of the Relation of Adenoma and Hyperplasia of the Sebaceous Glands.*—Under hypertrophy of the sebaceous glands, Unna says that simple hypertrophy of the sebaceous glands appears partly as an accompaniment of other processes, partly as an independent tumor. The independent tumors are rare; much more frequent is the more or less diffuse hypertrophy of the glands, which chiefly accompanies the chronic forms and results of seborrhœic catarrh, especially of the nose and the middle of the forehead.

Adenoma of sebaceous glands, Unna calls "Steatadenoma." "The definition of adenoma can certainly not be applied, where the sebaceous gland epithelium produces solid bodies, which grow into solid epithelial masses or epithelial cords; we have, then, some form of acanthoma proceeding from the sebaceous gland. The participation of the sebaceous gland in an epithelial growth, proceeding from the follicle or the surface epithelium, is a very frequent occurrence accompanying the most varied inflammatory and hypertrophic conditions." "It thus appears as if we must abandon the definition of steatadenoma in the strict sense of the word, since the benignant tumors of the sebaceous glands are either hypertrophies or acanthomata of the sebaceous glands. But there might also be tumors occupying a median position between the condition just mentioned, in that, for example, solid bodies first come from the sebaceous epithelium, which, after they have developed in a tumor-like fashion, again recall their point of origin by fatty degeneration of their cells. Then we would have a growth in a new direction agreeing with the definition of an adenoma, if we retain it, and at the same time the proof that the cells of the growth had not lost their character as sebaceous cells during growth. If no such tumors were to be found, then it would be better to abandon altogether the term 'adenoma of the sebaceous glands;' but there is the case recorded by Bock which agrees with the following strict definition of steatadenoma, benign tumor-like growths of irregular formation proceeding from the epithelium of the sebaceous glands, in whose outgrowths fatty but no colloid metamor-

phosis takes place." Unna quotes from Bock, and says, "The development of the glandular lobules took place from below upward. Bock founded the diagnosis steatadenoma on the triple recognition, first, of the normal behavior of the sweat-glands; second, of the absence of cancerous processes, and, third, of the presence of acini, which in their development, evolution, fatty degeneration, and calcification corresponded with sebaceous glands." In conclusion, he says that one must admit that this origin would have been still clearer, if, at the more recent parts of the growth, a true formation of sebaceous glands had been recognized, with a reticular spongy character of the cell protoplasm, as in the fatty changes in true sebaceous cells.

RÉSUMÉ OF THE LITERATURE OF HYPERPLASIA OF SEBACEOUS GLANDS, EITHER ALONE OR SECONDARY TO HYPERTROPHY OF THE SKIN.

Pringle,[15] in 1890, reported a case of many small, indolent, firm, whitish, solid papules or little tumors of the face embedded in the skin, the largest the size of a small pea and near the nasolabial fold. When pricked with a pin, white sebaceous matter could be expressed. The superficial layers of epithelium along the whole section were rather thin; the rete showed excessive and irregular involution, dipping deeply into the subjacent derma. The chief pathological changes were found in the corium; its upper papillary layer was enormously hypertrophied, but it was in the deeper layers that the essential lesions lay. They consisted of an enormous increase in number and complexity of the sebaceous glands. The gland epithelium was everywhere well formed, the acini at no spot exhibiting retrogressive changes. A good microphotograph was given; also a chrome lithograph of a girl's face studded around the nose and on the cheeks below the eyes with small flat tumors. He cites Balzer's [16] cases, and agrees with him in using the term "adenomata."

Caspary,[17] who followed Pringle in 1891 with a very similar case, described a girl's face covered with small nodules. He showed a good lithograph and microscopic sections of the conditions. He gave Pringle's as the sixth and his as the seventh case on record.

Pollitzer,[18] in 1893, described and gave a clear photograph of a group of thirty small adenomata, as he calls them, on the forehead of a man twenty-five years of age, in whom the condition had lasted six years. Each nodule was as large as a medium-sized barley-corn. Two were cystic and sebaceous matter could be expressed from almost all. The microscopic examination of excised specimens showed that almost the entire specimen was made up of sebacous gland tissue, which had preserved the lobulated

arrangement of the normal gland. The resemblance in both the appearance of the cells and their arrangement to normal sebaceous glands was so close that he suspected it to be hypertrophy of the gland. Actual measurement of the individual gland cell showed no increase in size beyond the normal, and there were far more than the normal number of lobules. The condition, then, could only be called adenoma. He gives a cut, and says, "Two club-shaped processes of epithelium may be seen shooting out from the side of the root-sheath of a hair, exactly like the buds from which the glands are formed in the embryo. Near the end of one of them a small island of epithelial cells appears as if cut off from the growing shoot. Such an isolated group of cells would, as they underwent their physiological fatty degeneration, necessarily give rise to a sebaceous cyst. Sweat-glands appear normal and far below the tumor." He said there were scarcely twenty cases of this rare disease observed, and this was the first and only one in America. He mentioned Crocker's, Jameson's, and Caspary's cases.

Unna says that if any one attempted to apply the term adenoma to peculiar forms of simple sebaceous hypertrophy in such cases as those of Pringle and Caspary, it would be impossible to draw the line, and we should have to call every enlargement of the sebaceous glands adenoma.

Pezzoli,[19] in 1900, described a very similar condition, and mentioned that Balzer and Ménétrier were the first to describe it in 1885. He gave a case of a great number of very small discrete tumors on the face of a young girl, showing a picture of the same, also a cut of a microscopic section.

Walther Pick,[20] in 1901, described with great care and detail a diffuse mass of small cystic skin tumors on the face of a man suffering from acne rosacea. The cysts were filled with a homogeneous material, and some of the cells were degenerating; also, some of the cell-bodies were much swollen, and at times fine protoplasmic scaffolding was seen which is found in normal sebaceous gland cells. The nature of the degeneration he attempted to prove by orcein stain and orange tannin. In normal sebaceous gland ducts, the dye stained the material a light yellow, and the cyst contents the same color. He also gave several very good lithographs of a diffuse hypertrophy or adenomatous condition of the sebaceous gland and hypertrophy of the skin, with no real tumor formation.

SUMMARY.

It is seen from a consideration of the cases cited by Bock and others, that, although denied by some observers, true adenomata of the sebaceous glands, without associated lesions of the skin, do exist, and that these adenomata undergo fatty metamorphosis with a formation of cysts. Tumors of this sort are rare, large ones especially so. On the other hand, adenoma, or an hyperplastic condition of the gland, secondary to or together with hypertrophy of the skin, is not so uncommon.

True adenomata of the sebaceous glands may become calcified or carcinomatous. The stroma of the tumor may undergo hyaline degeneration. Giant cells may occur in them.

The epithelial cells may undergo mucous degeneration and form cysts similar to those derived from the cell undergoing fat metamorphosis.

It has been shown that the tumor which is the subject of this paper is neither a dermoid cyst nor a simple inclusion cyst, nor is it derived from a supernumerary mammary gland, or the sweat-glands. It would therefore appear that the growth is a true adenoma starting from the infundibula of the sebaceous glands and retaining the type of the secreting portion. It thus has all the characteristics of a steatadenoma or adenoma of the sebaceous glands; namely, the presence of acini, which in their development, evolution, fatty metamorphosis, and calcification correspond to sebaceous glands.

I am indebted to Professor T. M. Prudden, Dr. John H. Larkin, and Dr. Charles Norris for many suggestions in connection with this article.

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THE TREATMENT OF HÆMATEMESIS BY GASTRO-ENTEROSTOMY.[1]

WITH REPORT OF CASE.

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In cases of hæmatemesis, two lines of operative treatment are available,—the direct and the indirect. The direct includes the theoretically ideal methods, and others less ideal, but still acting primarily upon the source of the hæmorrhage. The indirect methods are those operative procedures that exert a healing or hæmostatic influence, in some manner not involving the ulcer itself.

These two methods may be classified as follows:

A. Direct.
1. Excision of ulcer.
2. Partial gastrectomy or pylorectomy.
3. Ligation of the principal artery.
4. Cauterization or curettage of ulcer.
5. Ligation of mucous membrane.
6. Ligation of all coats.

B. Indirect.
1. Gastro-enterostomy.
2. Pyloroplasty.
3. Gastrotomy.

In considering Class A as a whole, it will be found that there are many reasons why these methods are impracticable, and many times cannot be carried out.

These objectionable points are such as the difficulty of locating the ulcer; the source of a hæmorrhage sufficient to cause death may easily escape detection. The fact that in 20 per cent. of the cases the lesion is multiple, the presence of

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firm and vascular adhesions, sometimes to adjacent and important organs, such as the pancreas; likewise the indistinct limitations of the pathological tissues. All of which have tended towards making impracticable the direct methods of attack of the bleeding point.

As to the choice of these methods, it would seem to lie between ligature of all coats, as recommended by Andrews, and partial gastrectomy or excision of the ulcer, if the last two are practicable.

The high mortality rate of some and the impracticability or the unreliability of the others of the direct methods have been the cause of a general turning to the indirect methods, especially to that apparently all-healing operation, gastro-enterostomy.

The exact manner in which a gastro-enterostomy usually causes a healing of the ulcer is a question more or less debatable. But the explanation usually acccepted is, in effect, as follows: The anastomotic opening allows of a comparatively perfect drainage; the stomach is rapidly emptied, is therefore given rest and quiet; the hyperchlorhydria is diminished, and, as the opening is at the most dependent portion of the stomach, and to the left of the ulcer-bearing area, the ulcer is not irritated by prolonged contact with the stomach contents.

It has also been claimed that the admittance of the small amount of bile and pancreatic juice that find their way into the stomach exert a beneficial influence upon the ulcer.

In certain cases, where the gastro-intestinal opening becomes closed because of the improved and more patent condition of the pylorus, the symptoms of gastric ulcer, and even hæmorrhage, have been known to return. As to whether this is due to the formation of new ulcers, or to a revival of the old, it cannot be definitely stated.

As to the stopping of gastric hæmorrhage, by the performance of a gastro-enterostomy, such substantial reasons as those stated above for the healing of the ulcer cannot be presented.

The chief reason for expecting hæmorrhage to cease after the operation will be on account of the rest given to the

stomach by the new opening, so, to a large extent, doing away with peristalsis, and at the same time allowing the organ to contract; and also the lack of irritation of the bleeding point by the stomach contents.

These conditions, and others, do, without doubt, favor the stopping of hæmorrhage and the formation of a clot.

But that there are cases in which these measures are not sufficient to arrrest the hæmorrhage, cannot be doubted. And it would certainly seem unreasonable to expect such round-about and indirect measures to stop a profuse hæmorrhage in instances where a large artery has been opened laterally, as in the case reported with this contribution to the subject.

And even in cases where the bleeding was found to be due to a parenchymatous oozing, the operation has been known to fail to arrest the hæmorrhage. It would seem that, as a method of stopping hæmorrhage from a large artery, it cannot be relied upon. And that in cases in which the bleeding comes from the smaller capillaries, it is practically, but not always, sufficient.

The amount of the hæmatemesis will be found to be no criterion as to the size of the bleeding vessel; in cases that have rapidly terminated fatally, the bleeding point has been so small as to escape detection at autopsy, even in the hands of the most expert.

On the other hand, cases in which the bleeding vessel has been found to be of such caliber as the splenic artery, life has persisted for weeks, after the beginning of the hæmorrhage. Therefore, as we are not able to determine, with any reasonable degree of accuracy, as to the nature of the source of the hæmorrhage, it would seem that a gastro-enterostomy was indicated *only* after a thorough search for the bleeding point.

The exact status of gastro-enterostomy as a hæmostatic measure in gastric hæmorrhage is not definite, as may be very forcibly brought out by the following quotations from Moynihan and from Robson:

Moynihan says:

"Surgical intervention is rarely needed in cases of hæmorrhage from acute gastric or duodenal ulcer. When it is called for, gastro-enterostomy speedily performed is the surest means of arresting the hæmorrhage. A search for the bleeding point is futile, and harmful, and unnecessary. Search for and local treatment of the ulcer or the ulcers is not necessary. A gastro-enterostomy will without doubt prevent recurrence of the hæmorrhage, and lead to a rapid healing of the ulcer from which the blood has come."

Robson says:

"If no ulcer be found anywhere, and the bleeding proves to be capillary, or from small undiscoverable ulcers, gastro-enterostomy should be performed; but if an ulcer be discovered, and it be possible to excise it, that operation should be done, as it undoubtedly offers the likeliest method of cure."

And again, in speaking of an acute case, he says:

"Case V illustrates the feasibility of exploring the stomach, even in a patient brought very low by excessive loss of blood, and although the ligature of the chief bleeding point was effected, it was deemed advisable to secure rest for the stomach by performing a posterior gastro-enterostomy, especially as it could be done without materially prolonging the operation."

The ideas expressed in the first quotation, that a search for the bleeding point is futile, harmful, and unnecessary, because a gastro-enterostomy will, without doubt, prevent recurrence of the hæmorrhage, has apparently been gaining headway. But that the assertions are hardly in accordance with the facts can be seen from the Case V of Robson's series, and many others in the literature.

To emphasize the conflicting opinions, I will quote the following extracts:

Moullin. "In every case in which it is practicable, I am strongly in favor of dealing with the ulcer directly in preference to performing a gastrojejunostomy."

Buck. "An operation for acute hæmatemesis, whether from an acute or chronic ulcer, seems to me to be an emergency operation, in which one would not feel satisfied unless one performed that for which the operation was undertaken, and secured the bleeding point."

Butlin. "The best plan is to open the stomach, and if the bleeding

point cannot be found, then to do gastro-enterostomy; but to operate on the bleeding point is the best surgery."

HABERSHON could not see how gastro-enterostomy could check the hæmatemesis when the ulcer was far from the pylorus.

SYMONDS considers the operation certainly to be indicated when the ulcer is situated near the pylorus, but to be of doubtful advantage when the lesion was elsewhere.

HAYEM found that the subsequent histories of patients upon whom gastro-enterostomy had been done for simple ulcer showed that there is very likely to be a return of symptoms, with hæmatemesis, gastric crises, or perforation. These symptoms, in his opinion, being due to the formation of new ulcers, or, more rarely, to carcinomatous changes in the old ulcer.

That gastro-enterostomy does not, without doubt, prevent recurrence of the hæmorrhage will be proven by the case reported with this article, and by others collected from the literature.

These cases are, in brief, as follows:

SAVANARIAUD noted reports of two cases in which the patients vomited blood after the operation of gastro-enterostomy.

The first by Roux. Patient had hæmatemesis for some time before the operation. The evening of the same day, and the next day, considerable blood was vomited. Ultimate recovery.

The second by Porge, who did gastro-enterostomy for a tumor which obliterated the pylorus. On the fifth day after the operation the patient died. Autopsy found the intestine full of blood; a recent ulcer in the vicinity of the common duct had caused the hæmorrhage.

RYDYGIER says, "Cases are known where an hæmatemesis has killed the patient, notwithstanding a gastro-enterostomy that had been made before." And that he has met with one such case in his experience.

L. FRANK cites the case of an ulcer at the lesser curvature adherent to the liver, in which he did gastro-enterostomy en Y. Patient did well for four days, and then had a return of the hæmatemesis and died. Autopsy showed two ulcers; an open artery was found in the base of one, from which the bleeding undoubtedly came.

KOCHER says, "That these methods (pyloroplasty and gastro-enterostomy) lead to healing has been proven, but not always. I have seen, after an uneventful recovery of a gastro-enterostomy, a hæmorrhage from an ulcer lead rapidly to death."

PETERSON reports a case of gastro-enterostomy performed for hæmorrhage. "Ten weeks after this operation the patient died from hæmorrhage from the stomach, which very likely came not from an ulcer but from the parenchyma."

KORTE mentions one case (out of seventeen operated upon while the

ulcer was "open") in which the hæmorrhage continued after the performance of a gastro-enterostomy.

According to A. T. CABOT, "Korte reports two fatal cases of hæmorrhage from ulcers eight and twelve days after gastro-enterostomy." But from a careful search of Korte's contributions to the subject in different publications, we have been unable to find the second case, but did find a case of operation for hæmorrhage in which gastrotomy was performed, and the ulcer, near the lesser curvature, cauterized with the Paquelin. Death in this instance occurred on the eighth day from a recurrence of the hæmorrhage.

A. W. MORTON reports a case of acute hæmatemesis; at operation no evidence of ulcer was found by an examination of the external surface of the stomach. Therefore he did an anterior gastro-enterostomy. Death occurred on the second day. At autopsy there was found to be no peritonitis, button well taken, considerable blood in stomach and bowels. Two large ulcers on the posterior wall of the stomach.

ROBSON cites a case, which possibly had better be differentiated from the others, because it was thought to be one of carcinoma; but as the differentiation of ulcer from carcinoma in this class of cases is at times most difficult, and as it is interesting, in showing the influence, or lack of influence, of gastro-enterostomy upon hæmatemesis of a possible carcinomatous origin, a brief synopsis of the case is here appended.

Woman, forty-two years of age, gave a history of five attacks of severe and alarming hæmatemesis. At operation found a tumor of the pylorus, with so many enlarged glands that, had it been malignant, its removal would have been useless; in consequence, a gastro-enterostomy was done. Recovery from the operation was uneventful. But at the end of a month, while sitting up, husband reading to her, she suddenly collapsed and died within a quarter of an hour; profuse hæmorrhage was evidently the cause of death. Blood oozed from the anus. No autopsy. It was thought that the carcinoma or the ulcer invaded either the portal vein or the vena cava.

The AUTHOR'S CASE is in brief as follows:

Acute, non-symptomatic, repeated hæmatemesis. With the exception of an attack of typhoid fever one year ago, previous and personal history negative.

On June 9, 1903, while in apparent health, vomited about two pints of bright red blood.

On the 10th, at about the same time of the day, had a similar attack of hæmatemesis.

On the 12th, two hæmorrhages occurred, of about a pint each, one in the morning and one in the evening.

On the morning of the 13th, another hæmorrhage took place. As medical treatment seemed to be of no avail, and as it was

feared that another hæmorrhage might prove fatal, it was decided to operate.

An examination of the external surface of the stomach gave no clue as to the location, nor the character of the bleeding point. And as a hasty examination of the mucosa failed to reveal the point, an anterior gastro-enterostomy was performed.

Patient did nicely for two days, and then became weaker, no vomiting, but blood passed from the bowel. Death occurred on the morning of the fifth day.

Autopsy revealed the site of the anastomosis intact and water-tight; no peritonitis; the stomach and bowel contained considerable blood.

After removing and opening the stomach, a typical round ulcer, one-half by one-fourth inch in dimensions, was found on the anterior wall, near the pylorus and the lesser curvature.

Microscopic examination showed an eroded artery at the base of the ulcer.

As showing the necessity of direct operation, in some cases which cannot be determined upon without an examination, may be cited the case of Kocher, where the hæmorrhage originated from an ulcer, embedded in which was a cherry-stone.

The futility of gastro-enterostomy in such a case is very evident.

The fact that gastro-enterostomy may have little or no influence, as a hæmostatic measure, upon gastric or duodenal hæmorrhage is well emphasized by Eccles case, in which gastro-enterostomy was performed for non-malignant pyloric obstruction. The patient did well till the eleventh day, when he vomited blood, and died on the fourteenth day, after a profuse hæmatemesis.

At autopsy, the anastomosis was found to be perfect and patent. The hæmorrhage had evidently originated from an ulcer of the duodenum which had eroded the hepatic artery.

These cases tend to show that gastro-enterostomy is but an indirect and unreliable method of dealing with bleeding from the stomach; and while it has, in many cases, been fol-

lowed by a cessation of the hæmorrhage, and eventually a healing of the ulcer, it cannot be relied upon with any sense of security to stop the hæmorrhage in all cases.

Moullin, in speaking of this operation in this connection, says, "It is at best only a way of evading difficulties which are better met directly, before they have attained dimensions which render this impracticable."

And this statement will be found to be well fortified by the discussion of a recent article of Munro's, in which there is related five cases of gastric surgery, as follows:

1. Hæmorrhage, gastro-enterostomy, recovery from operation, death twenty months later, from cancer which probably existed at the time of the operation.

2. Hæmorrhage and dilatation, gastro-enterostomy, with entero-enterostomy, death with circular vomiting, sixteen days after operation.

3. Hæmorrhage and dilatation, gastro-enterostomy, entero-enterostomy, death within thirty-six hours.

4. Hæmorrhage and dilatation, excision of ulcer. Recovery, well two years after operation.

5. Hæmorrhage and dilatation, gastro-enterostomy. Recovery from operation, death one month after, due to colloid cancer.

The fact that in this series of four gastro-enterostomies two recovered from the operation, to subsequently succumb to carcinoma, should at least impress upon us the advisability of a more thorough search, and, if practicable, an attempt to prevent such a sequel.

In attempting to outline the indications for the operation of gastro-enterostomy in hæmatemesis, it may be stated that a thorough, faithful, and judicious search fails to reveal the source of the hæmorrhage; or if it is found and the conditions will not allow of one of the direct methods to be employed, then gastro-enterostomy may be performed.

This thorough search will add but little to the severity of the operation, as the examination of the internal aspect of the stomach can be made through the opening which is to be used in the gastro-enterostomy, if it is located at the lower portion of the greater curvature.

The question as to the advisability of supplementing one

of the direct methods by a gastro-enterostomy is not, as yet, settled.

The object of this additional step is to place the stomach at rest, and in this way favor the healing of the wound made by the direct interference. Also to act as a prophylactic measure, and to remove what is thought to be a cause of ulcer, hyperacidity and imperfect drainage of the stomach contents. Where there is marked dilatation, and other symptoms of ulcer, with the hæmorrhage, such an additional operation will usually be employed, if, in the operator's opinion, the condition of the patient will warrant it.

The performance of a gastro-enterostomy after radical treatment of the bleeding point will not add materially to the operation, as the anastomosis may be made at the opening in the stomach which was used for the exploration. But, on the other hand, the routine addition of gastro-enterostomy to direct treatment will undoubtedly increase the time and the severity of the operation to a greater or less extent.

The so-called "vicious circle," while markedly diminishing in frequency, is still occasionally encountered, even if the opening is placed at the most dependent portion of the stomach.

Ulcer of the duodenum, perforating or giving rise to hæmorrhage, following gastro-enterostomy, has occurred so frequently as to make it appear possible that such an accident might be more than a mere coincidence; and that gastro-enterostomy may be found to act as a causative factor has been suggested, and the question is under investigation. In 1900, Steinhall collected five such cases.

Peptic ulcer of the jejunum has also been described as a result of the abnormal condition caused by gastro-enterostomy. Brodnitz collected fifteen cases of this character in 1903.

All of these points should make us want sufficient evidence as to the necessity of gastro-enterostomy as a supplementary operation before it be accepted as a routine measure.

To recapitulate. Gastro-enterostomy is indicated in hæmatemesis,—First, after a thorough search has failed to reveal the source of the hæmorrhage; second, where the

source of the bleeding is discovered, but in such condition as to make direct treatment impracticable or impossible.

From a sad experience, and a review of the literature, we would, in conclusion, discountenance the idea, which has become quite prevalent, that nothing is to be gained by searching for the bleeding point, as gastro-enterostomy is all that will be necessary to prevent recurrence of the hæmorrhage.

POSTOPERATIVE INTESTINAL OBSTRUCTION.[1]

WITH A REPORT OF THREE CASES.

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OF NEW YORK CITY,

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FROM a study of the cases which form the basis of these remarks and of others of which the writer has personal knowledge; of cases recently presented before this Society and the Surgical Section of the Academy of Medicine, and of cases recently reported, which a brief and imperfect search of the literature has revealed, the writer has been impressed with the fact that postoperative intestinal obstruction is a condition the frequency of which is hardly appreciated, and the gravity of which cannot be overestimated. Three years ago, Dr. Hotchkiss read a paper before the New York Surgical Society reporting three cases successfully operated upon, and collected twenty other cases which had been reported to the Society since 1893. Of these, eighteen had been operated upon with eleven recoveries; one had yielded to vigorous abdominal massage under chloroform while the patient was held up by the heels (Briddon), and one recovered after the formation of an artificial anus (Wyeth). Warren reports a case of obstruction from a band extending from the appendicular site to the peripheral surface of a loop of gut, constricting another loop of gut beneath it; operated upon January 29, 1903, with recovery, the original operation having been performed June 14, 1902 (six and a half months before), for gangrenous appendicitis with progredient peritonitis. He states that this is the only case of this kind that he has had in his own operative work, a statement that I think few surgeons of his wide experience could make to-day. In addition to the three cases

[1] Read before the New York Surgical Society, May 11, 1904.

reported in this paper, the writer has personal knowledge of three unreported cases which resulted fatally, two following operations for appendicitis with peritonitis at intervals of four weeks and one year respectively, both operated upon for the obstruction; the third following salpingectomy closed without drainage, obstruction occurring two weeks later and death without secondary operation. In addition to the six cases mentioned, in five of which operation was performed and the condition verified, the writer has personally treated three other cases successfully by palliative measures, *i.e.*, repeated enemata, etc., one of these having had absolute obstruction for forty-eight hours with vomiting and distention when first seen, operation for suppurative appendicitis having been performed by another surgeon seven weeks previously; the case had been constantly under the care of a competent trained nurse, whose efforts to relieve the obstruction had been unavailing. Only the fact that the case was seen in a small country village late at night, and the impossibility of securing suitable assistance, deterred the writer from operating immediately, and constrained him to spend the greater part of the night in efforts at relief by enemata, position, etc., which fortunately were finally successful, and the patient reported more than a year later that there had never been any return of the symptoms. In these cases yielding to palliative means, there is no verification, of course, of the condition actually existing. It is frequently stated that the majority of cases of postoperative obstruction occur within the first two weeks or so following the primary operation, and this statement seems fairly well substantiated; the percentage of cases following this rule, however, is difficult to estimate, and many occur later. It is in these earlier cases that palliative and prophylactic treatment should give the best results, and in which often the risk and difficulty of the secondary operation are greatest. During the early convalescence from laparotomy for extensive inflammatory trouble, the coils of intestines are usually matted together by peritoneal exudate and adhesions more or less firmly, according to the time which has elapsed; during

the first few days the adhesions are soft and easily separated; later, say from two to four weeks, they may be firm enough to cause great difficulty in finding an obstruction and freeing the coils, as is well illustrated in a case recently reported by Deaver, where secondary operation for obstruction was performed thirteen days after operation for appendicitis with peritonitis. Many adhesions were broken up and the obstruction found in a tangle of coils of the lower ileum; much damage to peritoneal surfaces occurred, partially repaired with cargile membrane; eight days later a third operation was performed, 500 cubic centimetres of thin pus in pelvis with adhesions worse than ever and obstruction in the sigmoid; ultimate recovery. The great additional trauma necessarily inflicted at the second operation was undoubtedly responsible for the fresh infection and increase in adhesions. The same author states that he operated upon ten cases of obstruction following appendicitis in the year 1901, and that the obstruction usually occurs in the first ten to fourteen days after the primary operation. Dr. R. T. Morris stated, in a discussion of a case at the Surgical Section of the Academy, that he had been called to see a number of such cases in the early convalescence from laparotomy, but had not yet been obliged to resort to secondary operation, all his cases having yielded to vigorous palliative treatment, *i.e.*, elevation of the hips, abdominal massage, and enemata. The point I wish to emphasize is this, that many of the early cases of obstruction are due to kinks and bends, which only partially obstruct the lumen of the bowel until an attack of indigestion, or some indiscretion in diet, produces unusual gas formation in the afferent loop; with increased peristalsis acting against the point immobilized by the adhesion, the obstruction becomes complete, and gas ceases to pass the obstructed point. The condition rapidly goes from bad to worse unless promptly relieved by proper palliative measures, as, with the rapid accumulation of gas above the obstruction, the pressure at this point becomes greater and greater, and soon fresh adhesions render the condition absolutely beyond hope of relief except by operative

procedure. It is in this class of cases, however, that early palliative treatment will many times effect a permanent cure, for the first passage of gas past the obstructed point relieves some of the pressure above; more gas and fæcal matter follow, and the temporary relief becomes permanent if similar attacks can be prevented by rigid diet and avoidance of attacks of acute indigestion for a few weeks, until further absorption of adhesions occurs and the bowel again becomes free. It is a well known fact that adhesions formed between the intestines, as a result of operative procedures or inflammatory conditions, have a marked tendency to disappear in the course of time, the absorption and disappearance being greatly favored by the constant peristaltic movements of the intestines. I have opened the abdomen for ventral hernia two years after resection of intestine for gangrene accompanied by extensive peritonitis, where at the original operation packing was used, a temporary fæcal fistula developed, and extensive adhesions must inevitably have been present, and found at the secondary operation the intestines absolutely free from adhesions and the point of anastomosis indistinguishable, a few adhesions of the omentum to the parietes being the only remaining evidence of the former peritonitis. I have seen the abdomen opened for intestinal obstruction five years after laparotomy for extensive peritonitis of pelvic origin, with the use of quantities of gauze packing for drainage; the greater portion of the small intestine formed a globular mass the external surface of which was perfectly smooth, free from adhesions, and covered by normal peritoneum, the coils forming the mass being bound together by firm, old adhesions which prevented the motion which should have absorbed and freed the attachment of the coils from each other, in the manner in which the external surface of the mass, as a whole, and the other abdominal organs had been freed. Unravelling of the coils forming the mass resulted in a prompt recovery. Entanglement of coils in adhesions which will soon be absorbed if obstruction can be avoided for a few weeks, and the normal peristaltic movement of the bowel has an opportunity to do

its work, is nevertheless a condition of grave danger while it lasts; and it is of the utmost importance that all patients having been operated upon for inflammatory intra-abdominal conditions should be carefully watched during the first few weeks of convalescence, limited to a very simple diet, and have the bowels regulated with the greatest care by enemata or mild laxatives. They should be warned of the possibility of the occurrence of obstruction, and the slightest indication of constipation with colicky pain be promptly attended to. If, however, properly conducted palliative treatment in these early cases of obstruction fails to give relief within a very few hours, delay in operating cannot be too severely condemned, for each hour of unnecessary delay adds greatly to the perils of the operation, and lessens the chance of a favorable outcome. The later obstructions, as a rule, present an entirely different condition, as two of my own cases show: the bands are of strong, well organized connective tissue, or loops of gut are bound down by firm organized adhesions in such a manner that they act as bands constricting other loops of gut beneath them. In attacks occurring later than four to six weeks after the primary operation, the chances are greatly in favor of the obstruction being due to well-organized bands, or dense adhesions; and the hope of relief by palliative measures is much less than in the early cases. These cases also have, as a rule, passed out of the hands of the surgeon, and the symptoms of beginning obstruction do not generally receive as prompt attention as in the case of patients still in bed from the effect of the primary operation, many cases having reached this stage of marked distention, fæcal vomiting, and collapse when first seen, as in my third case. Attempts at palliative treatment in these late cases, even if seen at the commencement, should be very brief indeed, for not only are the bands or adhesions likely to be unyielding and firmly organized, but many of the original adhesions have probably been absorbed, and the obstruction easier of access than would be the case soon after the primary operation. The conditions most frequently followed by postoperative obstruction are, first, appen-

dicitis with peritonitis either localized or diffuse, the danger of obstruction being, as a rule, in proportion to the extent of peritoneal surface damaged and the amount of resulting adhesions. The amount of drainage used is another factor of great importance, for extensive gauze packing has undoubtedly been responsible for many cases of obstruction, more especially those cases following soon after the primary operation. Many cases occur, however, where little or no drainage has been used, as my own cases will show, two of them having been closed without drainage, and in the third the adhesions responsible for the obstruction were far from the site where drainage was employed. Nevertheless, the use of small incisions, the minimum amount of handling of the intestines and evisceration, the abandonment of gauze packing, substituting cigarette drains down to the stump of appendix or merely through the abdominal wall; methods so strongly advocated by Hotchkiss, Blake, Morris, and others should have a decided tendency to diminish the number of cases of postoperative obstruction. Secondary abscesses following suppurative peritonitis are sometimes the cause of obstruction, although it is rarely, if ever, due to the pressure of the abscess itself on intestinal coils, but rather to the zone of surrounding adhesions. That it may follow an operation for non-suppurative or interval appendicitis closed without drainage is shown by one of my own cases; but this is probably quite rare, unless adhesions existed and the exposure and trauma of peritoneal surfaces at the primary operation were considerable. Suppurative conditions of the female pelvic organs are probably the next most prolific source of postoperative obstruction. Here the amount of damage to peritoneal surfaces is often extensive, and coils of intestine dropping back into the pelvis become cemented together, and to the pelvic walls and viscera, forming a most difficult condition to deal with if obstruction occurs. Inflammations of the gall-bladder or stomach are less frequent but occasional causes. The symptoms are the usual ones of an acute obstruction,—colicky pain, vomiting, distention, and prostration; and the diagnosis is usually clear

except in cases which may simulate or be complicated with a spreading peritonitis following immediately upon the primary operation. It is altogether probable that some deaths attributed to postoperative peritonitis are actually due to mechanical obstruction, especially in the cases where large quantities of gauze packing are employed; in many of these cases both conditions exist simultaneously, and it is impossible to distinguish between the two. Such cases are, as a rule, unfavorable for secondary operation, as the discouraging results of the secondary operation for postoperative peritonitis are well known. It is this class of cases that the enterostomy recommended by Finney and Pancoast may at times be indicated, giving temporary relief without attempting to search for the site of obstruction. In cases following operation for appendicitis, if the original wound is healed, the best incision is probably the Kammerer through the right rectus sheath, as the obstruction is located in the majority of cases in the right lower quadrant of the abdomen. If there is still a suppurating sinus in this region, it should be cleansed thoroughly with hydrogen peroxide or swabbed with a saturated solution of permanganate of potash, and then sealed with a collodion dressing or adhesive rubber dam, and a median incision made. The site of obstruction should be reached with as little evisceration as possible, as handling of greatly distended intestines adds much to the operative shock, and often hastens an early fatal issue. It is preferable in certain cases of great distention to draw a single loop out of the wound, incise it with proper protection of the surrounding operative area, evacuate as much gas and fluid fæces as possible, suture with two tiers of continuous silk Lembert stitches, cleanse with peroxide and flush with salt solution, and return to the abdomen, repeating the process on two or more loops if necessary, until the search for the obstructed point is successful. When found, each case presents its own indications for treatment; adhesions, kinks, and bends are freed, and intestinal contents allowed to pass into the collapsed portion of the gut below the obstruction. If this portion distends freely and

no lower obstruction exists, the abdomen may be closed at once. Bands are divided and the gut wall at the point of obstruction carefully inspected; if damaged so as to endanger perforation, or gangrenous, immediate resection with end-to-end anastomosis, or the formation of an artificial anus, are the two alternatives presented: preference should be given to the anastomosis in the majority of cases; the additional time and shock required for the adjustment of a Murphy button as compared with the formation of an artificial anus should be inconsiderable in the hands of skilled operators, and the ultimate danger to the patient is greatly lessened. If there has been much trauma in the separation of adhesions, etc., with considerable oozing or soiling of the peritoneal surface, the abdomen should be freely flushed with hot salt solution, otherwise it should be omitted and the abdomen closed at once. Drainage is rarely required, except in cases of resection where the viability of the gut wall or the perfection of technique is in question, when a cigarette drain may be placed down to the point of anastomosis.

In cases following operation for pyosalpingitis or pelvic inflammation, the incision should always be median, with perhaps the use of the Trendelenburg position as in the original operation. In other respects the technique is the same. Patients should be put to bed with the head elevated (Fowler position), and rectal irrigations or high enemata given every three hours until a satisfactory effect is secured in the passage of gas and fæcal matter. No cathartic should be given until after the distention has been thoroughly relieved from below. External heat, stimulants, etc., as for other cases of shock. If vomiting persists, lavage should be used. The following three cases illustrate some of the conditions found at varying lengths of time after the primary operation. In Case II, at eight days, the adhesions were soft and easily separated, but involved all the coils in the pelvis; the obstruction, a knuckle of gut doubled upon itself in Douglas cul-de-sac, was quickly found and easily relieved. In Case I, at five weeks, many of the original adhesions had already been absorbed, and those

that remained were quite firm and difficult to separate. In Case III, at eleven months, one strong, well-organized band of connective tissue was the only intraperitoneal evidence of the former operation.

Case I.—C. S., aged ten years. Patient had been ill for five days with abdominal symptoms which were diagnosed as colitis until seen by Drs. Raymond and Tyler, of New Rochelle, on the morning of September 4, 1902, when appendicitis was diagnosed and immediate operation advised. Later in the day she was brought to New Rochelle Hospital, and prepared for operation. When first seen by the writer the same afternoon the abdomen was distended, there was extreme general tenderness and rigidity, most marked, however, in the right iliac region; temperature, 102.5° F.; pulse, 140. Ether was given, and a 2.5 inch oblique incision made in the right iliac region; on opening the peritoneum, a large amount of thin seropus escaped, chiefly from the pelvis and lower abdomen, the right iliac fossa, and the region to the right of the ascending colon as high as the liver. There were apparently no limiting adhesions. Peritoneal cavity was then protected with gauze pads, and a large retrocæcal collection of fœtid pus evacuated; the stump of the appendix lay in the wall of the abscess cavity and was ligated, the major portion of the organ having sloughed away. All areas were thoroughly cleansed, and cigarette drains carried into pelvis up towards liver and into abscess cavity at stump of appendix. Time, thirty minutes; condition, poor. The patient was not seen again by the writer until October 9, 1902, thirty-five days after the operation described. She had made good recovery, the wound having healed except for a shallow sinus in abdominal wall. Her general condition had greatly improved and her appetite had become ravenous. On October 7 she began to vomit and her abdomen became somewhat distended; gas and some fæcal matter, however, were passed. On October 8 the obstruction was evidently increasing in spite of repeated enemata, and by the morning of October 9 had become complete; vomiting constant but not fæcal, pulse rapid, weak, and irregular, and general condition poor. Distention had increased steadily, was central, and not extreme. Under light ether anæsthesia a three-inch median incision was made below the umbilicus; small intestine distended to the size of a man's forearm presented, and a short

search disclosed the part below the obstruction completely collapsed, the large intestine also being empty. The gut was rapidly traced until the point of obstruction was revealed; it proved to be a coil of ileum attached to the left upper portion of the posterior abdominal wall, near the lower end of spleen and splenic flexure, forming a tense cord between this point and the ileocæcal junction, beneath which a double coil of small intestine was constricted in such a manner that the upper portion alone was distended (*i.e.*, a high obstruction, in the jejunum). The adhesion was separated with some difficulty, and a coil of ileum adherent near the hepatic flexure also freed; the intestine rapidly inspected, the abdomen flushed with salt solution, and closed by layers in the usual manner without drainage. Gas and some fæcal matter passed within the first few hours, vomiting continued at intervals for about forty-eight hours, diminishing gradually, at the end of which time good movements of the bowels were obtained and further convalescence was uneventful.

Case II.—Mme. L. C., aged thirty-four years. Patient was operated upon August 27, 1898, for suppurating hydronephrosis, nephrectomy of right kidney being performed. She developed ether pneumonia after the operation, and had a high percentage of albumen in the urine from the other kidney for some time, but finally recovered. Since that time she has had one child at term now alive and well, and several miscarriages, the last three days before her admission to the French Hospital on March 19, 1902, when she was curetted for retained secundines. Examination under the anæsthesia at that time showed a double tubal enlargement, and twelve days later (March 30, 1902) laparotomy was performed. Both tubes contained pus and with the ovaries, which were involved and adherent, were removed. As the vermiform appendix was attached to the right tube and secondarily inflamed, it was removed and the stump inverted. The operative field was cleansed with salt solution and the abdomen closed without drainage. The patient reacted nicely, passed sufficient urine, which was not albuminous; bowels moved freely on the third day; temperature and pulse were normal, and convalescence seemed well established. No further movement of the bowels occurred, however, and on the fifth day she began to show signs of intestinal obstruction; repeated enemata were ineffectual, vomiting persisted and became fæcal, the pulse became rapid and weak, and on the

seventh day her condition seemed so desperate that operation seemed inadvisable. The writer wishes to state that on the fifth day after the operation he left the city, supposing the patient to be convalescing and out of danger, and knew nothing of the obstruction until the seventh day, when on his return he found the condition as described. During the next twenty-four hours, in spite of the fact that there was no relief of the obstruction whatever, the vomiting became less frequent, and the general condition improved sufficiently to warrant an attempt at surgical relief, and on the eighth day after the salpingectomy the abdomen was reopened under chloroform anæsthesia.

Enormously distended coils of small intestines presented in the wound, the large intestine being empty; after a short search the site of the obstruction was found low in the ileum, a knuckle of the gut in the pelvis being sharply angulated and constricted by a band of adhesions. The adhesions were quickly freed, the gut straightened, and its contents forced into the collapsed portion. The abdomen was flushed out with salt solution and closed without drainage; time about thirty minutes. Rectal irrigations of hot saline solution were given every three hours; the passage of gas and fæcal matter occurred, and the patient began to improve. From that time recovery was uneventful.

Case III.—A. T., aged twenty-one years. Admitted to Roosevelt Hospital, March 13, 1903, suffering with a mild attack of appendicitis of two days' duration, the third attack within a year, all mild in character and of one to three days' duration. Had not been confined to bed by any of the attacks. He was operated upon by the House Surgeon the following day (March 14, 1903) by an intermuscular incision; appendix thick, congested, somewhat adherent at the tip, base covered with peritoneal reflections. The appendix was removed in the usual manner, its base inverted with a purse-string suture of chromic gut, with an additional Lembert suture. The abdomen was closed without drainage in the usual way. The wound healed per primam. Sutures all removed on the eighth day, patient sat up on the eleventh day, and left hospital well on the thirteenth day. He remained well until three days before his readmission, on February 14, 1904, on the service of Dr. Weir, when, without apparent cause, he began to vomit, and could not retain anything on his stomach. He also began to have general abdominal pain and dis-

tention, and his symptoms grew steadily worse up to the time of his admission. His bowels had not moved for four days, the vomiting was fæcal in character, and he was much prostrated. The abdomen was distended, tympanitic, moderate general tenderness, expression anxious. Operation was performed at 10 P.M. under light ether anæsthesia. A four-inch median incision below umbilicus; greatly distended coils of small intestine presented in the wound, dark and congested, so tense that the peritoneal coat cracked in places on handling. After a short search the point of constriction was found a few feet from the ileocæcal valve, the gut below being collapsed and empty, as was the large intestine. The obstruction was caused by a dense, narrow band of fibrous tissue passing between two coils of intestine in such a manner that it almost completely surrounded the gut at one point, causing complete obstruction. The band had no apparent connection with the cæcum. It was divided, a weak spot in the gut wall at the point of constriction protected with Lembert sutures, and the attempt made to return the intestines to the abdominal cavity. This could not be accomplished until the gut had been incised in two places, allowing the escape of a large quantity of gas and fæcal matter. These incisions were closed with two tiers of Lembert sutures. The peritoneal cavity was irrigated with salt solution and the abdomen closed without drainage. The patient's condition was extremely critical; he was infused upon the table, but did not react from the shock, and died at 2 A.M.

Conclusions.—The possibility of postoperative obstruction should be borne in mind in all abdominal operations, especially in conditions likely to result in extensive adhesions, *e.g.*, appendicitis with peritonitis; pyosalpingitis with pelvic peritonitis. All raw surfaces should be covered as much as possible with normal peritoneum, or, where this is not practicable, perhaps with cargile membrane, or carefully arranged omentum. Small incisions and the least possible manipulation and evisceration should be the rule. The cleansing of the peritoneum should be done rapidly and with the least possible trauma and handling of normal peritoneum. Flushing with hot saline solution is advisable where there is much foreign material to be removed. The smallest possible drains should

be used, if any; cigarette drains are preferable to gauze, as they are less irritating to the surrounding peritoneum; cases of pyosalpingitis or pelvic peritonitis rarely require drainage, and, when necessary, drainage through the cul-de-sac can usually be employed. Diet and regulation of the bowels should be watched with the greatest care during the first few weeks of convalescence; attacks of gaseous indigestion with colicky pain should be regarded with suspicion and treated promptly and vigorously. Determined effort should be made to relieve early attacks of obstruction by enemata, position, gastric lavage, etc., and if successful, patient should be kept on a scanty fluid diet for some time and watched most carefully for possible recurrence of symptoms. If palliative measures are unsuccessful after a few hours' trial, operation should be promptly resorted to. In cases occurring later than four to six weeks, palliative measures are less likely to be effective, and early operation is usually imperative. All patients who have been operated upon for intra-abdominal inflammatory troubles should be warned of the possibility of the occurrence of obstruction before leaving the care of the surgeon, impressed with the importance of avoiding indiscretions in diet and attacks of indigestion, and of seeking advice promptly if such attacks should occur. The operative procedure must be adapted to each individual case; the right Kammerer incision for cases following appendicitis with complete healing is often useful; the median incision, as a rule, for other conditions. Resection and end-to-end anastomosis should be preferred to enterostomy in the majority of cases where gangrene or sloughing of the gut wall demands one or the other.

MESOSIGMOIDITIS, AND ITS RELATIONS TO RECURRENT VOLVULUS OF THE SIGMOID FLEXURE.

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VOLVULUS of the sigmoid flexure has long been known as a pathological and clinical entity. The cases of death caused by this form of intestinal obstruction have been numerous in the days when abdominal surgery had not attained to its present efficiency. In fact, pronounced cases of volvulus of the sigmoid practically all died under medical treatment, while according to the latest reports as much as two-thirds of the cases operated on during the attack have been saved. Statistics, however, are of comparatively little value in a consideration of this subject, as the methods employed, and the time when they were employed, vary to such an extent in the hands of various operators, that it is useless to try to draw conclusions from a simple statistical collection of cases reported. But the pathology and the clinical course of these cases have come to be so well understood that there is very little doubt as to what treatment is the most rational one.

Volvulus of the sigmoid used to be discussed as a form of intestinal obstruction, but the discussion has gained infinitely in depth and results, since associated conditions have been duly recognized, which oblige us now to connect volvulus of the sigmoid with a considerable number of closely related pathological changes in the abdominal and pelvic viscera.

As a basis of this discussion, I may relate a case which I operated on some time ago.

History of the Case.—B. H. M., male, forty-three years old, machinist, born in Germany. Patient has had typhoid fever thirty years ago, rheumatism in the knee ten years ago, soft chancre five

years ago. In 1892 he noticed discharge of pus and blood from the rectum, and was operated on by Dr. M. for hæmorrhoids. He was better for six months, then began to notice pain in the region of the sacrum, which has continued ever since. In 1899 he was operated on by Dr. F. for hæmorrhoids and a small ulcer. Again he improved for six months. But the pain over the sacrum soon increased again. For seven or eight years patient now and then had nausea, depending more or less on the food ingested. At times the nausea would lead to vomiting of water and bile, never blood. The abdomen was often noticed to be bloated, particularly so during the last month. After the meteorism and the nausea and vomiting have lasted a few days, patient discharged suddenly large quantities of gas and fæcal matter, then watery stools, and, later, hard scybala. Then great relief followed temporarily. Since the last operation patient has not passed any blood, but he has noticed pus and mucus repeatedly, especially after a hard passage. Appetite was always good. Patient lost some six pounds in the last year, present weight is not quite 172 pounds.

Patient complains now of a pulling, burning, and bearing-down sensation over the sacrum and coccyx. This sensation is relieved when he pushes the anus upward.

This history indicated an obstacle to the fæcal passage, probably in the lower bowel, as the vomiting was never copious or excessive or fæcal in character. The presence of pus and mucus in the bowel movements indicated some ulcerative process, also probably low down. The fact that patient felt complete relief at times would speak in favor of a benign obstacle, though the age of the patient was a point in favor of a malignant neoplasm. As blood had not appeared in the stools since the hæmorrhoids had been operated on, I was inclined to exclude malignant neoplasm, because the time since the last hæmorrhoid operation was almost five years. If a malignant neoplasm had been the cause of the patient's passing blood and pus, he would not have survived for that length of time.

The examination of the patient revealed the following status:

Patient is tall, strongly built, muscular. His descriptions of his trouble suggest neurasthenia. Temperature, 99° F. Heart, lungs, liver, spleen, kidneys, glands negative. Urine normal. Anus and rectum normal to palpation and inspection. High up a diffuse infiltration of the paraproctic tissue is to be felt. In the

abdomen a pear-shaped tumor of the size of a child's head is palpated. It is slightly tender to the touch. Its narrow end is in the left iliac fossa, while its rounded extremity reaches towards the right side beyond the median line. There is a tympanitic sound on percussion over it. It is moderately movable. Stomach and intestines are not dilated.

On examination under anæsthesia (February 13, 1904), during the manipulation of the tumor through the abdominal walls a large amount of gas and soft fæces intimately mixed with mucus is evacuated, whereupon the tumor disappears completely.

The location of the tumor, its shape, its mobility, the slight amount of pain over it, the absolutely normal condition of all other parts of the intestinal tract, as far as could be determined by clinical examination, particularly, however, the fact that during manipulation the tumor disappeared after evacuation of a considerable amount of soft fæcal matter with large amounts of mucus and gas,—all this obliged us to make a diagnosis of volvulus of the sigmoid flexure, which had been redressed by the manipulation under anæsthesia. The patient's complaint of a tugging and pulling sensation in the region of the coccyx could be explained as due to a pulling on the rectum, produced by the rectum being wound up, if I may say so, by the twist of the sigmoid. But the fact that this tugging sensation was present not only when the patient had the nausea and vomiting, but more or less constantly; furthermore, the very fact that the nausea and vomiting occurred in spells, between which the patient felt complete relief, indicated that we had to deal with a combination of two processes, one recurrent and one stationary, the first the volvulus of the sigmoid, the second a condition which favors the occurrence and recurrence of the first.

A chronic inflammatory condition of the mesosigmoid leading to the formation of scar tissue in and retraction of the mesosigmoid is found associated with the volvulus (whether as cause or effect will be considered more closely below). This condition I expected to find on operation, and announced my diagnosis accordingly before the operation.

The operation was performed February 15, 1904, under ether anæsthesia, and lasted about twenty minutes. The abdomen was opened in the median line between umbilicus and sym-

physis. Immediately the sigmoid came into view with a very thick mesosigmoid. The latter presented on both surfaces white and glistening stripes of chronic peritonitis, which ramified all over it. The sigmoid was not twisted when the abdomen was opened, but a slight impulse given to the upper half of it sufficed to make it drop over the lower half. Numerous enlarged glands were felt in the mesosigmoid, the base of which was very short. There was considerable accumulation of fat in the mesosigmoid. The sigmoid itself was almost empty. No Graser's diverticula could be seen. The mesosigmoid was attached to the parietal peritoneum of the anterior and lateral abdominal wall by a number of interrupted cumol catgut sutures placed at a distance of about one inch from the sigmoid. The abdomen was closed by four layers of continuous cumol catgut sutures.

A few hours after the operation the patient had a natural bowel movement. During the convalescence the bowels moved several times every day without any laxative. Temperature and pulse remained normal (highest temperature, 99° F., with pulse at 76 on the third day). Patient walked about from the second day on. The incision healed by primary union. Patient left the hospital on March 2.

He was seen again repeatedly since the operation. On May 1 he reports his appetite excellent; his bowels move daily; no mucus in the passages. Some tugging and pulling are still felt over the sacrum. He has resumed his occupation and is able to attend to his duties without difficulty.

The operation and its success have therefore confirmed our diagnosis of the mesosigmoiditis, and make the latter appear fully as important as the temporary and recurrent volvulus.

From a review of the course of similar cases as reported in literature, it becomes evident that many cases never go beyond the initial stages of more or less obstinate constipation, with now and then some nausea or vomiting and pain in the abdomen. But the surgeon is rarely so fortunate as to get the patient for observation and treatment in this early stage, and I suspect that many cases belonging to this class are not recognized, if they do reach the surgeon in this stage. Usually, the surgeon is not called in until a sudden attack of

volvulus, with a more or less pronounced twist of the sigmoid, has obstructed the passage of the fæces completely.

Then the picture of ileus dominates the clinical aspect. The patient is in intense pain, vomits first stomach contents, soon fæcal matter. The bowels are distended, frequently in a very peculiar manner. The rectum is found empty and no passage can be produced. It is not necessary here to go further into the well-known signs of the complete intestinal blocking. It is necessary, however, to mention the peculiar way in which the dilatation of the intestine frequently is manifested in this particular class of obstruction. Two portions of the colon manifest a particular tendency to enlargement, one absolutely characteristic of the volvulus, the other merely indicating that the colon is blocked low down.

The characteristic distention is described as a palpable, often visible tympanitic tumor reaching from the left groin towards the region of the stomach, and representing the dilated sigmoid, which becomes erected, and the loops of which may come into close apposition.

The second dilatation, which sometimes overlaps and obscures the characteristic distention of the sigmoid, is a distention not of the portion of the colon immediately above the sigmoid, as one might expect, but of the cæcum. The cæcum under these circumstances may attain enormous dimensions. It may become as large as a man's thigh, and this may occur while the colon transversum and descendens are practically empty. This distention of the cæcum, of course, takes place only when the ileocæcal valve is absolutely tight. This condition of the cæcum is of the greatest importance, not only because the fatal perforation may take place here instead of in the sigmoid, but because it may lead to great confusion, if the operator is not aware of this peculiar condition and looks for the obstacle in the ascending colon instead of in the sigmoid.

If the volvulus of the sigmoid is not relieved, gangrene of the sigmoid, perforation, and peritonitis lead to the fatal end. But the perforation may occur in the cæcum before the

sigmoid bursts, or ulcerations in the descending colon above the volvulus may perforate and give rise to the fatal peritonitis.

It might be expected that the volvulus would be the more dangerous the more the sigmoid is twisted, that is, that a twist of 360° would be more certain to lead to gangrene than a twist of only 90°. But the cases reported in literature prove abundantly that such is not the case. Cases with a torsion of only 90° have led to gangrene of the whole sigmoid and fatal perforative peritonitis in less than twenty-four hours, while in other cases a twist of 270° and more had not produced perforation or even complete gangrene in a much longer time.

This observation necessitated the search for circumstances that might increase or decrease the dangers due to the volvulus itself. The findings in the course of the operations gave satisfactory evidence of such an additional factor. This factor is the mesosigmoiditis, *i.e.*, the chronic inflammatory condition of the mesosigmoid, which has resulted in a cicatricial shrinking of the peritoneal folds of the mesosigmoid as well as of the tissues between the folds. Wherever the cases were observed carefully, wherever the acute changes produced by gangrene and peritonitis allowed of such observations, this chronic retractive process in the mesosigmoid has been found. White stripes of scar tissue branch out over both sides of the mesosigmoid, make it rigid and hard. The retraction peculiar to all scar tissue tends to shrivel up the mesosigmoid. The cicatricial hardening is not limited to the peritoneal folds, but the whole substance of the mesosigmoid loses its soft, pliable condition and becomes hard and stiff like felt, as could be well observed in the case described here. An observation which I have not found recorded in literature, but which was perfectly established in our case, was that of enlarged and hard glands throughout the mesosigmoid.

This cicatricial degeneration of the mesosigmoid elucidates as much as it complicates the course of volvulus of the sigmoid. It is evident that the more scar tissue there is in the substance of the mesosigmoid along and around the blood-

vessels the greater the danger of interference with the circulation. We understand, then, why, with a high degree of mesosigmoiditis, a slight degree of volvulus may lead to rapid gangrene and perforation of the sigmoid, while with a more moderate amount of interference with the circulation in the mesosigmoid even a torsion of 360° might not lead to very rapid and complete shutting off of the blood supply of the sigmoid flexure.

The importance of this mesosigmoiditis is further shown by the fact that in a number of cases the symptoms of volvulus were present and the patients died from perforative peritonitis, where there was no real volvulus, but only pronounced mesosigmoiditis (for instance, two cases reported by Kuhn). Here the shrinking of the mesosigmoid shut off the fæcal current as well as the blood circulation, and still the post-mortem showed no volvulus. In our case, also, we found no volvulus at the time of the operation, though the tumor which had been observed two days before the operation, and which had disappeared under manipulation, indicated that volvulus had been present. Still, it is possible that in our case, as well as in Kuhn's two cases and in three similar ones reported by Riedel, there existed no genuine volvulus, but rather a kink of the sigmoid produced by the shrinking of the mesosigmoid. The forms and shapes assumed by the mesosigmoid in this process of chronic inflammation and shrinking vary a great deal. While in some cases the mesosigmoid is fairly well spread out, so that the bands of cicatricial tissue are seen branching out all over it, in other cases the retraction of the shrinking connective tissue has brought the two halves of the sigmoid into such close approximation, that they lie perfectly parallel to each other in the shape of a double-barrelled gun. Besides, bands may take their course from one part of the sigmoid or mesosigmoid to other points on the bowel or the mesentery.

Gersuny describes a special band at the point where the colon descendens passes into the sigmoid. He calls this band a typical one, with a typical course running across the outer fold of the mesosigmoid. Gersuny states that this fold or

band is the cause of symptoms long before volvulus occurs. Pain in the lower part of the abdomen on both sides is attributed by him to this typical band.

Enough, I think, has been said to demonstrate the importance of this cicatricial retraction of the mesosigmoid in itself. All authors agree that it favors greatly the occurrence of volvulus by approximating the fixed points of the sigmoid. As a matter of experiment, I gave the sigmoid a slight twist in our case, when the abdomen was open, and it took only a very slight push to make the proximal end of the sigmoid fall forward and over the distal end. This experiment again favored the theory of the causation of volvulus by the mesosigmoiditis, and furthermore increased the probability that in our case we had to deal with a recurrent volvulus, not merely a kink of the sigmoid.

While the association of mesosigmoiditis with volvulus is generally accepted, the question as to which is the primary affection is not so readily decided. The fact that mesosigmoiditis has been found alone and unassociated with volvulus, and that all well observed cases of volvulus have been found associated with mesosigmoiditis, might be considered sufficient proof of the primary existence of the mesosigmoiditis. But it might be urged that a condition of recurrent volvulus of the sigmoid would tend to produce such inflammatory changes in the bowel that the mesentery would readily be affected and take part in the inflammation, and subsequently be subject to cicatricial changes. On the other hand, it is well to point out that volvulus without pathological conditions in the mesentery is not likely to occur; though it is true that Koch, for instance, describes congenital anomalies in the mesentery which might lead to volvulus as a secondary and inflammation and cicatrization of the mesosigmoid as a tertiary condition. The varieties of incomplete or abnormal development of the mesentery of the sigmoid are as numerous as the deviations from the normal in other parts of the bowel. This must lead us to a consideration of the possible causes of the mesosigmoiditis apart from the question of volvulus.

Chronic inflammatory changes of the mesentery occur in many parts of the intestinal tract. They may be associated with volvulus, as, for instance, in the mesentery of the small intestine (Philipowicz), or may occur without it, where the anatomical arrangement does not favor the occurrence of a volvulus, as, for instance,—and very frequently,—in the meso-appendix. The chronic parametritis atrophicans described by Freund,—a condition so long regarded as something extraordinary and hard to find or observe,—I consider to be analogous. In fact, I should call it the shrinking mesenteritis of the uterus, and would thereby deprive it of its isolated position in pathology and bring it closer to our understanding.

Excepting two specimens reported by Riedel, no microscopic examinations of the mesosigmoiditis are to be found. But changes identical in macroscopical aspect occur frequently in the meso-appendix, and are easily demonstrated there. The pathology is that of a newly formed and shrinking connective tissue with more or less round cell infiltration. We cannot be far from the truth in assuming that the cause is very much the same in the mesosigmoid as in the meso-appendix. In the appendix, my researches (to be published soon) have taught me that very minute ulcerative changes afford ready entrance to infection. This favors inflammatory affection of the neighboring lymphatic structures in the meso-appendix. I do not know anything about small ulcerations in the sigmoid, because sigmoids are not removed and examined fresh in such numbers as appendices.

But some recent researches of Graser's have demonstrated a possible cause of the mesosigmoiditis in the spurious diverticula which he found. Graser met these diverticula in the sigmoid in ten out of twenty-eight cases examined, proving thereby that the sigmoid is a seat of predilection for the formation of the diverticula. In early stages, these diverticula are lined with epithelium and covered by the muscularis mucosæ, and partly by the circular muscular layer, while the longitudinal layer is absent over them. They follow the paths reserved for the blood-vessels in their course through the muscular layer

in the same way as similar formations which I have demonstrated in the Fallopian tubes and in the gall-bladder. The diverticula of the bowel are usually arranged along the mesenteric border, as here the vessels enter and leave. Their formation, according to Graser, is favored by stagnation of fæcal matter in the bowel and by venous stasis in the vessels, whereby the paths of the blood-vessels, or emissaries, as Graser terms them, become widened. These diverticula often become the seats of ulcerative changes, become adherent to neighboring organs, may lead to perforation into them. In this way, for instance, perforation from the sigmoid into the bladder may occur leading to the passage of fæces through the bladder or of urine through the rectum.

In the earlier stages, before the diverticula have become large, when they have just begun to show small ulcerations, an inflammatory affection of the mesosigmoid could readily be understood as a consequence of such multiple ulcerations. It is safe to prophesy that this association of diverticular ulceration and mesosigmoiditis will be frequently discovered in the near future. In the case described above, I looked for these diverticula, but, owing to the thickened and opaque condition of the mesosigmoid, it was impossible to ascertain whether diverticula were present or not.

Besides the diverticula minute ulcerations might be suspected to occur in the sigmoid, particularly where congenital anomalies favor stagnation of fæcal matter in this organ. The lining epithelium of the bowel is now well known not to afford the complete protection against infection which we used to attribute to it. The investigation of the appendix vermiformis has largely destroyed the confidence which we used to place in the perfection of the protective fence arranged against the septic contents of the alimentary tract.

Ulcerations in neighboring parts of the bowel are known to be able to produce the same condition of mesosigmoiditis as described in cases of volvulus. A case which I operated on the same morning as the case which is the subject of this report, illustrated this very beautifully. I had to perform colostomy

on a patient with multiple fistulas in ano, almost impermeable stricture of the rectum, and ulceration of the rectum above the stricture. When I pulled up the sigmoid, typical mesosigmoiditis was found to be present, though there was no question of volvulus in this case. But the inflammatory and cicatricial hardening of the tissues, which existed around the ulcerated rectum, had extended to the mesentery of the sigmoid. I did not see any diverticula, and the mesosigmoiditis was not so extensive as it was in the case of volvulus. Still, the white bands spreading and branching over the mesosigmoid were absolutely typical.

This case of mesosigmoiditis after rectal ulceration with its extension all around the stricture and deep into the tissues of the perineum seemed to offer a further explanation of the tugging and burning pain which the volvulus patient complained of. He also presented a thickening of the tissues surrounding the rectum high up, which could be discovered by rectal palpation, and which may have originated in the small ulcer for which he was operated on by Dr. F. The hardening of the paraproctic tissue, which Freund, for instance, in his description of the parametritis chronica atrophicans mentions also, may easily be conceived to be the cause of pain in consequence of pressure on the nerves and ganglia of this region. This hardening itself cannot be cured by any treatment, and may explain why the volvulus patient is not free from disagreeable sensations to this day. Though it is possible to restore normal evacuations of the bowel by operation, it is not possible to cure by operative or other means the chronic induration of the connective tissue. I have observed this same difficulty in a case of recurrent volvulus which I operated on in 1900. The patient at first continued to complain of disagreeable sensation in his abdomen, but he is well and hearty now and attends daily to his hard work. It may be assumed that with the regulation of the action of the bowels, produced by the operation for the volvulus, the previously existing ulcerations in the bowel may heal, and, no further infectious material being carried into the

mesentery, the inflammatory condition of the mesentery may quiet down and the patient recover, with the old scar tissue in the mesentery not troubling him any further or even softening up. In the same way we see indurated cicatricial tissue around ulcers in other parts of the body heal and grow soft after the ulcer is healed, as, for instance, in cases of varicose ulcers of the leg.

These considerations and the clinical observations mentioned prove that mesosigmoiditis in itself is a pathological entity deserving our attention. Whether it leads to volvulus or not is perhaps a minor question. It may do so or it may not. Its treatment, at any rate, is inseparable from that of the volvulus, and a brief discussion of the methods to be used in the absence of acute volvulus may be permitted here.

The treatment which was carried out in our case was that first advised by Roser and Roux. It is important to remember that Roux himself had to operate three times on one case, because the volvulus returned after the first two operations. Roux attributes this recurrence to insufficient extent of the suture, and advises to attach the mesosigmoid in its entire length. It is necessary to place the suture so that no artificial deep recess behind the sigmoid is formed, which might give rise to an internal strangulation. Therefore the lower part of the sigmoid has to be attached to the lateral rather than the anterior wall in order to prevent this formation of a pocket. It is easier and safer to attach the mesosigmoid to the anterior abdominal wall rather than to the posterior wall on account of the important structures of the posterior wall, which might be injured or interfered with by the sutures (ureter, iliac arteries, and veins).

Riedel's method of dissecting out the cicatricial bands has been carried out by him only. It would seem that any dissection of these cicatricial masses would only lead to the formation of new scars and favor more adhesions.

The resection of the sigmoid in cases of mesosigmoiditis, as first advised by Obalinsky and as carried out during the interval by von Eiselsberg and Steinthal, is the most radical

method, which ought to be reserved for the most pronounced cases of shrinking of the mesosigmoid, or cases where the shrinking and the recurrent volvulus are complicated by irreparable changes in the substance of the bowel, such as, for instance, would be represented by Graser's diverticula, or where the shrinking of the mesosigmoid has advanced to the formation of a "double-barrelled" sigmoid, if such a condition should ever be observed outside the acute volvulus. A Roux operation, even with the addition of Riedel's procedure on the bands, would evidently be impossible, and certainly insufficient in this condition of the "double-barrelled" sigmoid.

Anastomosis of the two ends of the sigmoid close to its points of attachment as advised by Braun would seem to favor recurrence of the volvulus, as it would tend to render the line of attachment of the sigmoid extremely small.

Entero-anastomosis between cæcum and descending loop of the sigmoid, the method of necessity sometimes in acute volvulus, is objectionable in the absence of acute volvulus, because the anastomosed parts of the bowel course free across the abdominal cavity after this operation, and thereby favor formation of knots and strangulation of loops of intestine, unless the operation be combined with a Roux attachment.

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MECKEL'S DIVERTICULUM.[1]

WITH REPORT OF STRANGULATED INGUINAL HERNIA OF SAME.

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MECKEL'S diverticulum, or the diverticulum ilei, is sufficiently common to merit a greater familiarity with it than commonly exists, and its importance arises chiefly from its relation to certain forms of intestinal strangulation, to the persistence from birth of a fæcal fistula at the umbilicus, and, more rarely still, to its presence in a hernia. It is my desire to place on record a case of strangulated inguinal hernia in which the sole contents was a Meckel's diverticulum. It may be of interest in this connection to give a general outline of this diverticulum, its origin, development, and subsequent changes.

Lavater is said to have been the first to record its having been observed, and Ruysh, in his "Thesaurus Anatomicus," published in 1701, also called attention to this abnormal development, giving it the name of diverticulum and presenting an illustration of the same. Morgagni, in his treatise on the "Seats and Causes of Disease," reports several cases of diverticulum of the ileum, and also mentions that he had a case of inguinal hernia in which it was found, and states, also, that he had seen the same diverticulum in geese, particularly one of such breadth that it could not be taken for the remains of that duct which has formerly belonged to the vitellum, thus recognizing its embryologic import and derivation.

We must, however, render to Johan Friederich Meckel the distinction of first calling a more general attention to the

[1] Read before the Ohio State Medical Association, May 19, 1904.

diverticulum ilei, which in his essay he most clearly differentiated from the acquired pseudodiverticuli occasionally found along the course of the intestinal canal. It was Meckel who advanced the theory that it represented the remains of the omphalomesenteric duct, which theory has received common recognition. He also called attention to its importance in the causation of certain intra-abdominal affections.

It is interesting to note that the American ornithologist, Elliot Coues, to whom the research of Meckel seems not to have been known, reports two cases of these rare formations under the name of umbilical cæca. His deductions are most interesting, as he not only arrives at the same conclusions drawn by Meckel fifty years previous, but from his knowledge of ornithology the more fully substantiates this theory. Coues states that in the Class Aves a true umbilical cæcum is frequently to be met with, forming a diverticulum or pouch, to which those described by him are at least in their material features quite similar. This diverticulum he states is situated at the original point of entrance of the vitelline duct into the intestine, and is the remains of, or rather an indication of, the previous existence of the duct. He further adduces the confirmatory fact that a remnant of an embryonic organ is quite persistent and very generally to be found throughout the lower orders of birds, as the Grallatores and Natatores, while in the higher orders, as in the Raptores and Passeres, it is only of exceptional occurrence and difficult of recognition.

Ahlfield, among others, denies that the diverticulum derives its origin from the vitello-intestinal duct, and claims that it is developed as the result of traction upon the intestines by the ductus-omphalo-mesentericus. This duct normally remains in connection with the intestine until the latter recedes into the abdominal cavity, or at about the third month. At this time discontinuity between the duct and intestine should occur. Should this disconnection not occur, manifold congenital variations of the gut may result. Among these variations is mentioned Meckel's diverticulum, it being the direct result of traction exerted upon the intestinal wall, which, gradually

giving way at the point of greatest traction, gives rise to the formation of such an appendage.

The relative frequency of the occurrence of this diverticulum was noted by Rolleston, of St. George's Hospital, to be ten in 337 cases examined, a percentage of 3.37 per cent. Osler observed it in 2 per cent. of cases. In the Collective Investigation of the Anatomical Society of Great Britain and Ireland, it was found sixteen times among 769 subjects, a trifle over 2 per cent. This is in accordance with the statements of Quain and Treves. Mitchell found it present in thirty-nine cases out of 1635 examined, or slightly over 2 per cent.; but remarks that its order of occurrence is quite inconstant; thus in 200 successive autopsies not one case was found, and then again its presence was noted in two successive cases. Kelynack found but eighteen examples among 1446 subjects examined, a proportion of a little over 1 per cent., while Albers says that it occurs about one time in 1000 subjects examined, making it $^1/_{10}$ per cent. This certainly seems too low an average. Out of Mitchell's thirty-nine cases, it was found four times in women and thirty-five in men. Kelynack in eighteen cases reports eleven as occurring in males to seven in females; there being thus a decided preponderance in frequency in the male. While the frequency of its occurrence has varied considerably according to the various observers, yet it will be found that its location is subject to still greater variance. Meckel's diverticulum is usually stated to be in the lower fourth of the ileum, at a variable distance of from one to four feet from the ileocolic valve, this being the position assigned to it by Meckel himself. Gegenbauer gives it at from one-half to two metres; Henle as one and one-half to three feet; Quain as an average of forty-eight inches, with a variation of from eleven to 120 inches. Tillman states it to be one-third to one and one-third metres from this point; Hemmeter says one to six feet, averaging two and one-half to three feet; Treves from fifteen to thirty-six inches; Kelynack gives an average of thirty-nine and one-half inches in eighteen cases examined with the extremes of fifteen to fifty

and one-half inches; Lamb, in a tabulation of 185 cases, reports it being situated in 21 per cent. between the ileocolic valve and one foot above this valve; in 19 per cent., two feet above the point; and in 12 per cent., two to three feet distant.

It does not seem, however, that the diverticulum is restricted to any particular portion of the intestinal tract, for it has been described as located anywhere from the pylorus to the ileocolic valve, and to have been found in the cæcal region as well as upon the œsophagus. The term diverticulum ilei is, therefore, misapplied, as it occurs in the jejunum in a considerable number of cases. Lamb found the record of fourteen cases in which it had occurred in the jejunum and of seven where it had been found in the duodenum. Buzzi reports a case where a diverticulum thirty-three millimetres in length was found on the jejunum opposite its mesenteric border and one metre distant from the duodenojejunal angle. From its anatomical character and the microscopical research, he concluded that it was to be regarded as a misplaced Meckel's diverticulum. Treves, however, cites this case as being a congenital diverticulum of the jejunum quite distinct in origin from Meckel's diverticulum. Similar cases are also reported by Clarkson and Collard, in one of which it was said to have its origin two feet from the pylorus. Dr. Elliot Coues reports two instances of this abnormal point of origin. Meckel refers to four cases reported by Walther and one by Grieding, in all of which the jejunum was the site of this vestigial structure, and considered them to be identical with those having their connection with the ileum.

Lamb states that it has been found seven times in connection with the duodenum, and refers to two cases in the Army Medical Museum. In one of these, a female mulatto seventy-one years old, it was found to arise from the middle of the duodenum, being about two inches long, and having its outer wall so thinned that the presence of the muscular wall seemed to be problematic. Albers also reports a case of this kind in which the diverticulum arose from the transverse portion of the duodenum. Mayers reported a case arising

from the duodenum, and containing a number of valvulæ conniventes for a short distance from its point of origin. Nor, as has been before suggested, has the remaining portion of the alimentary tract been exempt from its occurrence. Fitz, in a paper on "Persistent Omphalomesenteric Remains," refers to the well-authenticated case of duplication of the œsophagus, small intestine, cæcum and colon, and explains such anomalies on the assumption of an abnormally high or low seat of the omphalomesenteric duct. A duplication of this kind being of diverticular origin has originally a blind extremity; through the accumulation of meconium or pressure, perforation may result, and thus explain the communication with the intestine proper which usually exists at both ends. Fitz concludes his statement by saying that the view that most, if not all, well-authenticated instances of duplication of its course are the probable result of persistence, and growth of the remains of the vitelline duct is rendered highly probable from what is known concerning the development of the intestine.

The abdominal cavities are not differentiated at that period in fœtal life when the vitelline duct is present. The seat of the latter, high up or low down in the fœtus, would satisfactorily account for the various places of origin of the duplication in question, as it does for those of the diverticulum. It has already been made apparent that the latter may arise at any point between the pylorus and the cæcum. Whether the duplication or the diverticulum is to result, depends presumably on the existence of conditions favoring or checking the growth of the intestinal walls. The duplication is thus to be regarded merely as an elongated diverticulum, and, like the latter, as will be shown later, may lie within as well as outside the mesentery.

This variability of position can alone be explained along developmental lines. In its earlier state the intestinal tube or gut tract is differentiated into three portions: a head-gut which lies cephalad to the intestinal attachment of the vitelline duct, a hind-gut which lies near the tail end of the embryo, and the mid-gut or intervening third portion. Later, *i.e.*,

during the fifth and sixth weeks, when the pharynx, œsophagus, stomach, and part of the duodenum have become differentiated in the foregut, the mid-gut becomes U-shaped, and is then known as the umbilical flexure or navel loop. From this portion of the intestine are now developed the lower part of the duodenum, cæcum, and colon. At the point of greatest convexity of this flexure the vitello-intestinal duct is attached, and towards it, also, proceed the omphalomesenteric arteries. From the upper limb of the umbilical flexure is subsequently developed the jejunum and part of the ileum; from the lower limb, the remainder of the ileum, cæcum, and ascending colon. Since the point of attachment of the vitelline duct, as Heisler says, is not far from the termination of the small intestine, Meckel's diverticulum, when present, is connected with the lower part of the ileum at a point from one to three feet from its termination. In the subsequent development of the small intestine, however, different portions may be hindered in its growth, as Leichtenberg states, the greater part of the small intestine is formed from the posterior or lower leg. The diverticulum in such a case would then be placed abnormally, *i.e.,* in the jejunum or even duodenum. A retardation of growth in the lower limb would, on the other hand, explain those cases in which Meckel's diverticulum is found a short distance from the ileocolic valve. This is the view which has also been advanced by Fitz, who, relative to the variation in the position of Meckel's diverticulum, says, "Since the diverticulum is present, if at all, in the earliest weeks of fœtal life, it is obvious that its position with reference to the ileocæcal valve must change with the growth of the intestine. The preponderant elongation of the intestinal tube above the insertion of the duct is accompanied by a less longitudinal growth below this point, and the diverticulum is usually found in the vicinity of the valve." The occurrence of the diverticulum prolongation on the ileum, jejunum, and lower duodenum is most rationally explained by this theory. In the upper portion of the duodenum in its first and second parts diverticuli may, however, be of different origin. It is known

that the hepatic diverticulum, from which the liver is developed, may give rise through developmental defects and aberrations to certain of these congenital duodenal diverticuli. Such diverticuli also occur as isolated pouches, which, when present, are constant in position, *i.e.*, above the biliary papilla, according to Treves. Other objections to the assumption that the duodenal diverticuli are in their origin vitello-intestinal are also apparent in the cases reported.

In the case of Lamb, the absence of muscular fibres rather denotes an acquired character, and it can, therefore, not be considered a congenital structure. It belongs to the cases of false or pseudodiverticuli, to which attention had been called by Rokitansky.

As to the remaining parts of the alimentary canal (œsophagus and cæcum) in which the occurrence of duplication has been referred to, the abnormal position of the diverticulum and its subsequent growth, as already alluded to in the view of Fitz, are dependent on the primary connection of the vitello-intestinal duct and intestine, and does not result from a disproportion in growth of the digestive tract. The exact position of the diverticulum on the intestinal loop is in the great majority of cases along the free border of the gut or opposite to its mesenteric attachment. Yet this, too, is subject to variation. Kelynack observed that its origin was not always immediately opposite the mesenteric attachment. Kern in a case of patulous umbilicus, which he operated on, found that the Diverticulum Meckelli arose from a position which was not directly opposite the mesenteric attachment of the intestine, but which lay towards the lateral aspect of the gut; and Dennis, in his "System of Surgery," figures several specimens in which the diverticulum springs from the mesenteric border, and lies intramesenteric. In two cases reported by Mitchell (Cases 5 and 13) it arose from the side of the gut, in one of these close to the mesentery. Fitz, in speaking of this lateral variation, remarks that the instances are not few in which the side of the intestine, even the immediate vicinity of the mesenteric attachment, is the starting-point. He then

refers to a case in the Warren Museum, Specimen 732, an intramesenteric duplication of the intestine, which was found in a child from eight to ten months old. Two intestinal tubes more or less parallel are to be seen in this specimen, one being in the usual position of the intestine, the other to its inner side, between the two layers of the mesentery.

The diameter of the inner tube is somewhat smaller than that of the outer, except in the immediate vicinity of the opening, at which the two tubes communicate where a dilatation exists. The contiguous portions of these two structures are in close proximity to each other throughout the greater part of their course and are fused near the common opening. This opening is rounded, sharply defined, one-third of an inch in diameter, and appears to be covered with mucous membrane. The walls of these tubes are composed of mucous, muscular, and peritoneal coats; the mucosa of the outer tube showing slightly projecting transverse folds in the vicinity of the opening, while that of the inner tube is relatively smooth. Villi and crypts are said to be present in both these structures. Fitz concludes that in these cases the most satisfactory explanation of the origin of this anomaly is based upon its representing an intramesenteric diverticulum, although its bifurcated shape and seat of constriction and dilatation deserve special consideration. As both these characteristics may, however, be possessed by other diverticuli, this objection is not valid. Dennis reports a similar case of intestinal duplication where the accessory gut lay intramesenteric, and for the explanation of which the omphalomesenteric theory is advanced. The cases of intramesenteric cysts of Roth are also to be classed under this category of lateral variation of Meckel's diverticulum, as stated by that writer himself. Treves, however, remarks of these cases that it is a question whether the elongated diverticuli, which are described as growing between the layers of the mesentery, are real instances of Meckel's diverticulum, but gives no evidence as proof of this assertion.

The length of Meckel's diverticulum is in part dependent on the degree of involution the omphalomesenteric duct under-

goes. Normally, the involution of this embryologic structure is complete, and no trace of its former existence is to be found in man. When present, however, its length forms one of its most inconstant characteristics. It is found as a small, blunt, peglike projection, and varying up to a diverticulum ten inches in length. Its average length as given by Quain is one to three inches; by Rokitansky, five to six inches; by Henle, one-half to six inches; by Albers, one to seven inches; by Kelynack, one-half to six inches, or an average of two and one-quarter inches. Cazin gives it as one to seven inches, or eight inches; and Treves as two to three inches. Lamb, in a tabulation of 185 cases, found its length definitely given in 109 cases. In forty-four cases it was reported as being from one to two inches long; in twenty-nine, from two to three inches; in fifteen, from three to four inches; in five, from four to five inches; in two, six inches; and in one, seven inches. Lamb concludes that of the entire 109 cases, the number of those in which the diverticulum was between one to two inches long exactly equalled those in which it was between two to four inches, giving an average, therefore, of two inches in length.

The usual form encountered is the tubular variety resembling the finger of a glove. In such a cylindrical prolongation the diameter nearly equals that of the gut proper. In many instances the diverticulum when of this form tapers more or less gradually towards its blind extremity. According to Treves, the diameter of its base is usually less than that of the gut from which it arises, although sometimes the diameter of the two tubes may be nearly identical. It may also retain the same width throughout, and thus resemble a glove-finger; but its base is usually considerably wider than its free extremity. Tillman states that the diverticulum has sometimes a greater diameter than the small intestine itself. When attached to and patulent at the navel, the diameter throughout its course may remain unaltered, or be but slightly diminished at its umbilical attachment. Among the divergencies from this usual form are to be mentioned the presence of constrictions which may occur throughout its course, most usually,

however, towards one of its two extremities. At the junction of the small intestine such a constriction, when marked, gives rise to the globular or inversely conical variety, in which the diverticulum was connected with the ileum by a narrow mouth three-quarters of an inch wide, then extended to a diameter of one inch and rapidly widened into a large pouch almost as big as the cæcum. This dilated portion had a diameter of three and one-quarter inches, a circumference of ten and one-half inches, and lay quite free in the abdomen. Kelynack suggests that its large size is probably of an acquired nature, and that it may be referred to as a distention from the intestinal contents. When the constriction becomes complete in the globular variety, the communication with the small intestine may entirely, or almost altogether, cease, and the diverticulum, as Roth has shown in the report of several cases, give rise to an intra-abdominal cyst.

The extremity of the diverticulum varies considerably in shape. Thus it may be clubbed-shaped or, in rare cases, it may be bifid. Both Kelynack and Fitz refer to such cases. Treves speaks of a specimen in the London Hospital Museum in which the ampulla at the end of the diverticulum had a hammer-shaped outline. Hyrtl remarks that branch-like diverticuli are very rare, but reports an instance in which a diverticulum one inch in length and divided into five parts was found in a hemicephalic monster. More important than any of these cases are those in which the extremity is patulous and communicates with the exterior at the umbilicus. A patulous Meckel's diverticulum at the umbilicus gives rise to a fistula or what has been termed anus præternaturalis umbilicalis. This patulency is generally ascribed to the free end of the diverticulum extending through the umbilical ring into the umbilical cord, so that when the cord is severed the extremity of the intestinal appendages is likewise exsected. With the subsequent exfoliation of the navel the umbilical fistula is established. This view is advanced by Merian von Seibold and Shepard. Bart, on the other hand, claims that this does not occur, and the existence of a congenital umbilical hernia is

not essential for the patulency of the umbilicus to result. According to this writer, the extremity of the diverticulum merely extends to the umbilical ring, and does not pass beyond the same. A necrosis which may follow the separation of the cord can, however, establish an intestinal umbilical fistula.

In its structure, Meckel's diverticulum resembles the small intestine, being composed of three coats. In the muscular coat both the longitudinal and circular fibres are directly continuous with those of the small intestine. The mucosa is like that of the intestine, containing Lieberkuhn's crypts, solitary follicles, and Peyer's patches. Of the latter but one is commonly found, and when present is subject to the same pathologic changes as take place in the ileum. Vaughn reports a case in which at the autopsy of a patient, who died of enteric fever, a diverticulum was found seven and one-half inches in length, and containing two small swollen Peyer's patches near its origin and several enlarged ulcerating, solitary glands. At the junction of the diverticulum and ileum the mucosa in reduplicating may give rise to a valve. Meckel observed its presence in three cases out of over twenty examined. He interpreted its presence to be an attempt at closure. According to Buzzi, Klebs also mentioned its occurrence, as did Cazin and Albers, who referred to a valve-like formation similar to those found at the ileocæcal and appendiculocæcal junctions. Roth reports a case in which this valve almost completely closed the intestinal opening, and thus accounted for the small amount of intestinal contents which escaped through its fistulous opening at the umbilicus, the tube being large and patulous in its other parts. Structurally, this valve consists of a reduplication of the mucous membrane, between the two layers of which a certain amount of connective tissue is found; towards its attached end a few muscular fibres are also present. Roth says that a similar though much less distinct valve may occur at the umbilical end of a patulous diverticulum, ordinarily from the obliteration of the emphalomesenteric vessels, but may, according to Treves, be referred in some cases to the obliteration of a part of the diverticular extremity.

The occurrence of Meckel's diverticulum in a hernial sac has been frequently referred to by various writers and observers. Morgagni and Littre each report a case of this kind in a scrotal hernia. Meckel himself, and since his report many writers have mentioned and alluded to the possibility of its occurrence. Cazin, in the dissection of the scrotal hernia, describes a diverticulum found in the sac. Duplay and Reclus, also Ludwig and Tilling, have published in their surgical works and papers instances of umbilical hernia containing Meckel's diverticulum.

The hernias in which the diverticulum has so far been exclusively found are those of the umbilical and inguinal variety, and especially in the congenital type of the umbilical, or in the funicular hernia; there is a predisposing factor for the retention of Meckel's diverticulum in the hernial sac. According to Ahlfeld, the congenital umbilical hernia is caused by an abnormal thickness of the vitello-intestinal duct, which prevents the recession of the intestine into the abdomen, thereby giving rise to the formation of a hernia. The portion of the intestine attached to this duct is in all cases the last to enter the abdominal cavity, and therefore, when Meckel's diverticulum is present, and such a hernia exists, it is to be found among the contents of the intestinal protrusion.

To this class of congenital umbilical hernia belong the many instances of Meckel's diverticulum patulous at the navel, for in these cases the diverticulum is invaginated into the umbilical ring, and during the deligation of the cord its extremity is severed from the rest of the process. The intestinal coils which are found within the rupture of the inguinal region or an acquired umbilical hernia are, as is known, those possessing the longest mesentery. Elongation of the mesentery results from an actual increase in its length or from a ptosis of this structure. This was first pointed out by Richter to be an important factor in the causation of hernia. Anatomically, the longest mesentery is possessed by the lower ileum or by the same intestinal coils which are generally the site of Meckel's diverticulum when present. The fact that the lower ileum

possesses the longest mesentery can be referred to embryological development, that is, to the umbilical flexure in which the omphalomesenteric duct is found at the height of the convexity in the intestinal loop, which portion is already at this time attached to the longest mesentery. At this point, moreover, the mesentery may still be further elongated by retention of the intestine within the cord beyond the normal period, so that when recession does occur the mesentery is of abnormal length. In the further development of the gastro-intestinal tract this increased length may be retained, and there is then established one of the primary predisposing factors for the causation of a hernia, which, when occurring, has among its contents Meckel's diverticulum, if this should exist.

Usually, the diverticulum is found within the hernial sac in conjunction with the intestinal coils to which it is attached. More rarely the diverticulum is found alone within the hernia. There is then what may be termed a true hernia of Meckel's diverticulum.

Such a case is reported by Dowse in a female, aged seventy-seven years, in which an artificial anus had formed in the right groin. At a postmortem three months after the formation of the fistula, a direct inguinal hernia was found whose sac contained a diverticulum which arose from the lower part of the ileum. Its distal extremity was adherent to the anterior side of the sac to the extent of half an inch. The diverticulum itself was funnel-shaped; its widest end, about two-thirds of an inch in diameter, being at the ileum, and was connected with the bowel almost exactly opposite to the mesenteric attachment. It measured one and one-half inches in length, was pervious throughout, and its coats were similar to those composing the walls of the ileum. Its mucous membrane was well marked and corrugated, having several oblique folds or valvuli conniventes of a small size. The orifice of the sac lay to the inner side of the obliterated hypogastric artery, so that a direct inguinal hernia existed. The fæcal fistula which had resulted had probably been produced by the fæcal accumulation and distention of the diverticulum, which was followed by ulceration and perforation. Although in this case no mention is made of Meckel's diverticulum, it seems most probable, from the description given, that this was the structure involved. Of congenital umbilical hernia which contains Meckel's diverticulum, the following cases have been reported:

Schroder gives the case of Muller, who, in a dead-born fœtus eight months old, found an umbilical hernia which contained a blind Meckel's

diverticulum one inch long, and which was adherent to the neck of the sac.

Ahlfeld reports the case of a girl who died immediately after birth, which was slightly premature. She had an umbilical hernia which contained a diverticulum one to two inches long, whose extremity was adherent to the umbilical ring. A persistent omphalomesenteric artery running along the side of this diverticulum was also found. This artery lost itself in the mesentery of the small intestine near their junction.

Braus, in a child seven years old, found a protrusion at the umbilicus which measured eight centimetres, had a pedicle, and was but incompletely reducible. Upon opening the tumor, a Meckel's diverticulum was found, which was excised. Gluck, in a child born at seven months with an umbilical hernia and which had signs of peritonitis and strangulation, found that these symptoms had been caused by an accessory mesenteric fold bound to a diverticulum of Meckel's and passing over the intestine. A radical operation for umbilical hernia was performed, and both the diverticulum and mesenteric fold were resected.

Dunchamp reports a case of umbilical hernia in which operation was decided on, as the hernial sac was found thin and transparent, but quite reducible. Just as the operation was about to begin, the sac suddenly burst and the intestine flowed out en masse. Among the intestinal coils, the cæcum, appendix, sigmoid flexure, and a Meckel's diverticulum, two centimetres long and adherent to the herial sac by its extremities, were found.

Rosenblaum describes a case in which a persistent omphalomesenteric duct was found during the course of an operation for the radical cure of umbilical hernia.

Hallet gives the instance of a girl two hours old who had an irreducible hernia at the umbilicus the size of a fist. At the operation, the contents of its sac consisted of the cæcum with its appendix, and the small intestine with an adherent Meckel's diverticulum. A radical operation was performed, and the appendix and the diverticulum were removed.

Tiedeman, as quoted by Roth, found in a full-term male with a double cleft palate and harelip, and an accessory finger on both hands, an umbilical hernia the size of a walnut. Its contents were an intestinal loop, pyriform cyst fourteen and one-half lines in length, seven lines in width, and which had a pedicle or canal three and one-half lines long attached to the convex margin of the gut. The cyst contained a yellowish fluid and communicated through the canal with the lumen of the gut. Tiedeman thought this cyst to be the true umbilical vesicle. By Roth it is regarded as an enterocyst within a hernial sac.

Carle reports a case where, in an umbilical tumor, a hernia of Meckel's diverticulum was diagnosed. The operation confirmed the diagnosis. When the sac was opened, a small tumor, the size and form of a strawberry partly reducible, appeared. Its summit was pierced by an orifice, which led into a canal nine centimetres long, and from which a clear fluid with a fæcal odor oozed out in abundance. At birth the child, according

to the mother, was attached to a short cord about the thickness of a man's thumb.

In inguinal hernia, the diverticulum, though more rarely found, has been noted in the following instances:

According to Morgagni, Benevoli has described a hernia which was constituted of an appendix to the ileum and extended into the scrotum, although it communicated with the intestine by an orifice, which, in the dead body, was not larger than a middling sized filbert, yet during fifteen days the patient vomited everything he took into his stomach, and at an early period of the disease threw up matter which resembled excrement. The ileum, to the extent of half an ell, at the part corresponding with the hernia, was not of its natural color, and was exceedingly corrugated and contracted.

Morgagni then describes a case which came under his observation: an inguinal hernia containing an incarcerated diverticulum. A porter, fifty years of age and broken down with constant labor, had a hernial tumor in the right groin the size of a man's thumb. Sometimes it apparently vanished, but about the middle of March, 1706, without any obvious cause, he was seized with pain in the abdomen. The pain though wandering was so severe that he compared it with canine gnawing. On the sixth day he was brought into the Hospital of St. Mary de Morte. His skin was nearly cold; his pulse exceedingly frequent and small; nor did it offer but slight resistance to the fingers, but it struck them with unequal force. The whole abdomen was distended like a drum, especially below the right hypochondrium, where the coils of the colon could be distinguished by the hand. The hernia was exceedingly tense, but was not the principal seat of his pain. He vomited his food and voided no fæces, nor could he even expel flatus. He died on the evening of the ninth day.

Dissection. The omentum was found extending into the hernia, and, with the exception of some broad transverse lines, it was generally reddened by inflammation. The spleen exhibited a morbid lividness, which penetrated a considerable depth into its substance. The stomach and the tract of small intestines, as far as the hernia, were greatly distended with a yellowish matter resembling fluid excrement. The large intestines were contracted and white, and it was evident that nothing had passed through the part of the ileum connected with the hernia, although merely a process of the intestine crossing the orifice entered the sac. This process was constituted of a projecting portion of the parietes, and was in the form of a semi-oval cavity, the larger axis of which, where it commenced gradually from the intestine, was about three digits in the longitudinal direction of the intestine; but the smaller axis was much less. From this commencement it progressively contracted and extended to the length of an inch. This portion, therefore, whether denominated a cavity or a diverticulum, was the only part of the intestine contained in the sac with the extremity of the omentum. Neither of these parts,

however, could be withdrawn, not only from constriction in the orifice, but also in consequence of a fibrous adhesion to the sac. The sac itself was formed by the peritoneum, which protruded at the other side of the spermatic vessels, and on each side there existed an enlarged inguinal gland. That portion of the intestine which was contiguous to the sac, but more especially the diverticulum, was of a red color, inclining to lividness; and from this part to the stomach the coats of the canal were reddened by their turgid and crowded vessels, and the mesentery presented a similar appearance.

According to Thompson, Littre describes a case in which a Meckel's diverticulum four inches in length was found in a scrotal hernia of a man forty-eight years of age. Thompson reports the case of a colored man fifty years of age, with a left inguinal hernia, which had been at no time reducible and had been present for about ten years. On the day previous to that on which he was seen, it had occasioned him some trouble, and he had reduced it himself after attempting to do so for three hours, the rupture then entirely disappearing. During the night serious symptoms appeared, and in the morning the abdomen was somewhat tender and swollen on the left side. Vomiting at intervals of about half an hour; pulse, 120; temperature, 101° F. On opening the hernial sac, free fœtid gas, intestinal contents, and semipurulent fluid were discharged. The sac was entirely emptied and the internal ring free. Upon prolonging the incision upward towards the anterior superior spine, fæcal matter and pus were also evacuated from the abdominal cavity in great quantities. An unsuccessful search was then made for a perforation among the intestinal coils, which were matted together. Death shortly after. At the autopsy, which had been allowed only through the operation wound, a perforation was found at the base of a Meckel's diverticulum, which sprang from the ileum thirty-nine inches from the ileocæcal valve. The rent was two centimetres long, opening completely into the alimentary canal. At the apex and along one side were evidences of old peritonitic adhesions, which had probably bound it down firmly to the wall of the hernial sac.

Dugan gives the case of Vance, which was that of a delicate male child who had a reducible inguinal hernia, which became irreducible and strangulated. The usual operation for this condition was performed, strangulation having existed for six hours. The contents of the sac proved to be two coils of intestines ileum projecting through the ring with a Meckel's diverticulum wedged in between them, thus making reduction or taxis impossible. The diverticulum measured at least seven centimetres in length. Its lumen was as large as that of the gut. The usual steps for a radical cure were gone through with, the result being satisfactory. Banks, before the Liverpool Medical Institution, February 8, 1896, showed a Meckel's diverticulum which he had removed from the sac of a hernia, the small bowel being also present. It is not stated whether this was an umbilical or inguinal hernia.

Webster reports the following case. In a woman aged forty-two, who had fallen a few days before, a distended abdomen and a large tender mass in the left inguinal region, occupying the inguinal canal, was found.

Partial reduction was possible; but a hard mass looking like intestine was discovered, and on carefully opening the intestinal ring and separating the adhesions this was found to be a Meckel's diverticulum proceeding from close to the mesenteric border of the ileum, having a well-defined mesentery of its own. The mesentery was tied off and the diverticulum removed close to the ileum, and the opening of the bowel, which was of sufficient caliber to admit the tip of a finger, closed by a double row of Lembert sutures. The diverticulum measured three and one-half inches in length. The intestinal lumen was continuous for about three inches, the diverticulum ending in a mass showing some old inflammatory thickening. There was a good deal of inflammatory thickening of the ileum surrounding the diverticulum, showing that that portion had been constricted in the inguinal ring. The operation was completed by suturing the rings for a radical cure of the hernia. The patient made an uninterrupted recovery.

To these cases I wish to add the report of a case of strangulated hernia in which the contents of the sac consisted only of a rather large Meckel's diverticulum and a portion of the wall of the small intestine to which it was attached.

The patient was a male laborer, aged twenty-three years, who was admitted to Cleveland City Hospital, January 28, 1902, suffering from evident pain in his right groin and frequent vomiting. Twenty hours previous to his admission to the hospital, while lifting a heavy box, he was seized with a severe pain in the right inguinal region accompanied by a sudden tumor formation. This had never appeared before according to the patient's statement, but, as he was not a very intelligent man, reliance could not be placed on his statement. Vomiting soon set in, and persisted at frequent intervals, until upon admission to the hospital it was distinctly fæcal in character. Examination showed the patient to be suffering from shock, the abdomen was much distended, and the hernial tumor occupied the upper part of the scrotum and extended back along the inguinal canal. Under general anæsthesia, the hernial sac, which was very tense, was opened up and found to be filled with a dark, bloody fluid and what appeared to be a single knuckle of the intestine, resembling more a moderate sized gall-bladder. The peculiarity of its shape led to the pulling out of more intestine from the hernial orifice, and it was found to be a diverticulum six centimetres long by four centimetres in width. It was sharply constricted



FIG. 1.—Meckel's diverticulum.

at its neck where a portion of the ileum had been pulled down into the sac and seized by the constricting ring. The diverticulum and adjacent portion of the ileum, as shown in the photograph (Fig. 1), were black and apparently at the point of gangrene. Exposure and hot applications did not affect the color; being afraid to return it, I decided to resect the intestine, removing about ten centimetres of the intestine on either side of the diverticulum and uniting the resected ends by a Murphy button. The gut was then returned to the abdominal cavity and the operation completed by the Bassini method. The wound healed without suppuration and no special symptoms developed. The patient left the hospital, March 31, 1902, able to resume work. The button had not yet passed.

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CONTRIBUTION TO THE SURGERY OF THE DEEP URETHRA.

I. PRIMARY URETHRAL ANASTOMOSIS AFTER LACERATED WOUND OF THE PERINEAL URETHRA.

II. URETHRAL FISTULA, SEQUEL TO PROSTATECTOMY.

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I. *Severe Traumatism of the Perineal Urethra; Extensive Destruction of the Urethra; Primary Urethral Anastomosis.*—A young man, thirty-two years of age, had been under my care for a posterior urethral infection associated with a linear stricture of large caliber at the bulbomembranous junction. He had had recurrent attacks of what was supposed to be cystitis for several years. There were several strictures of large caliber in the anterior urethra. Considerable relief followed internal urethrotomy. As the irritation and infection of the posterior urethra persisted and was associated with spasm of the deep urethral muscles, following all attempts at instrumentation, perineal section was proposed, but was not submitted to. The chief argument against the operation on the part of the patient was the fact that a good-sized sound could be passed into the bladder, albeit with some little difficulty.

July 23, 1903, the patient was riding in a buggy behind a spirited horse, which ran away. He sprang out of the buggy just as it was swerved to the side of the street, where the front wheel came in contact with a horse-block. As the patient expressed it, the wheel rose to meet him as he came down astride it. He struck fairly upon the perineum, producing an injury which, considering the fact that the wheel was provided with a rubber tire of good size, was very remarkable. The perineum was torn through just in front of the anus, producing a large lacerated external wound, from which there was a severe hæmorrhage, the patient showing the effects of the loss of blood very plainly. He was taken to St. John's Hospital, Springfield, Illi-

nois, and I was telegraphed for. I saw him about eight hours after the accident. I found him suffering from the combined effects of shock and hæmorrhage. The local conditions were as follows: The scrotum and perineum were ecchymotic, and distended by an enormous hæmatoma. A ragged, lacerated, transverse wound about an inch and a half in length and curvilinear in form was seen in the perineum just anterior to the anus. There had been no retention of urine, a circumstance which was most fortunate for the patient, micturition being performed through the perineal wound. Without delay, a free incision was made from the base of the scrotum back to the margin of the anus, traversing at right angles the wound produced by the traumatism. A large quantity of clots was turned out from the perineum and scrotum. A large cavity was found anterior to the rectum, the hæmorrhage having in great part evidently come from the hæmorrhoidal vessels. The urethra was found to be disorganized throughout the entire extent of the perineal portion. The entire perineum might be said to be represented by a large irregular cavity, on the lateral walls of which the tendinous insertions of the glutei muscles could be seen. There was nothing remaining of the urethra in the perineal portion save a narrow irregular strip of the mucous membrane of the floor of the canal. Prior to incising the perineum, a large sound was passed, which missed the bladder altogether, and entered the cavity in front of the rectum. A catheter was also passed without the slightest resistance. This curled up in the cavity just described in such a manner that one might have conceived the notion that it had entered the bladder. The severed ends of the urethra were found with considerable difficulty. The canal had been torn across transversely, immediately in front of a stricture of large caliber at the bulbomembranous junction. The bulb had been torn transversely across and stripped up from the urethra both anteriorly and posteriorly.

It appeared that the fibrous tissue of the stricture had really protected the membranous urethra from laceration. The narrow stricture band was dissected out, after which the ends of the severed urethra were brought together over a full-sized sound, after trimming them smoothly with the scissors, and sutured by a continuous suture of fine catgut.

The surfaces of the severed bulb were next brought together

over the urethra and sutured. The perineal wound was partly closed and packed with gauze for drainage. A soft catheter was passed into the bladder and retained.

The course of the case was uneventful and primary union of the severed urethra was almost complete. The catheter was withdrawn at the end of ten days, and, despite the fact that daily irrigations had been made, it was found to be heavily coated with urates. In withdrawal, a slight separation of the line of union in the urethra was produced and a small amount of leakage followed. This, however, closed, and at the end of six weeks healing was complete. The urethra now admits a No. 33 French, and the case is in all respects in a most satisfactory condition.

One of the most interesting points in connection with this case was the fact that the perineal portion of the urethra was disorganized and the bulb extensively lacerated, while the membranous portion remained intact, showing that the point of division in traumatic rupture of the urethra is not always at a point corresponding with the subpubic ligament, the location almost universally described by the text-books.

The result obtained in this case, and others of a similar nature occurring in my experience, shows the wisdom of primary anastomosis of the injured urethra as prophylactic of extensive subsequent stricture. The condition in which I found the urethra and the perineum in this case was such as would inevitably have resulted in an extensive, intractable, traumatic stricture. It would, of course, be impossible to say what the ultimate result will be, but I feel confident from experience in other cases of the kind, that the anastomosis of the urethra will not be followed by stricture later on.

II. *Two Cases of Urethrorectal Fistula following Prostatectomy.*—It is not my intention to attempt in this paper the presentation of the various accidents that are liable to occur during or following prostatectomy, but merely to present two cases of an accident which is liable to occur in the practice of any surgeon who does a large amount of radical work upon the prostate, now that the perineal operation is so extensively used.

Case I.—Man, sixty years of age, with a moderately enlarged, hard, fibrous prostate. The perineal operation was employed, a Y-shaped incision being used. Enucleation was found to be impossible, and the overgrowth was removed by *morcellement.* The operation presented no unusual features. Perineal drainage with gauze and rubber tube were instituted. On the fifth day the drainage was removed. The parts at this time seemed in a perfectly healthy condition. On the eighth day following the operation, while an enema was being administered, the fluid was observed to return through the perineal wound. This being reported to me, I found on examination an opening which would easily admit the tip of the index-finger between the rectum and the track of the wound about an inch above the external sphincter. The sphincter and the rectal wall were divided to the level of the fistulous opening, in the hope that granulation would close the rectal wall as after the ordinary operation for rectal fistula. The result was disappointing, and a permanent fistula remained between the membranous urethra and rectum. Some months after the prostatectomy I operated for the closure of the fistula, the patient having been considerably annoyed by fæcal discharges through the urethra, and the passage of the entire urine by way of the rectum. In this operation I made a plastic upon the membranous urethra and upon the opening in the rectum. This operation was a failure. A month later I again operated by perineal rectoplasty. This operation proved a success.

Case II.—Man, aged sixty-five years. Large fibrous prostate. The patient had suffered from numerous attacks of retention, over a period of several years. For some months he had been compelled to rely entirely upon the catheter. The introduction of this instrument, at first easy and effective, became very difficult, was attended by severe hæmorrhage, and merely served to aggravate the symptoms. Prostatectomy was therefore proposed and consented to. Like the preceding case, this one proved very difficult, the prostate being so very hard that there was more than a suspicion of carcinoma, a suspicion which subsequent microscopical examination did not warrant. The overgrowth was removed by *morcellement,* great care being taken. A few days' drainage was instituted as usual. A few days after the operation the patient complained of severe burning in the wound, especially on micturition. The tube was removed, and the wound was found

to have an unhealthy appearance. A few days later it presented a very peculiar aspect. A thin eschar had formed on the wound surface. This was dry and adherent, and had much the appearance that would result from the application of the actual cautery. This eschar involved the tissues to the depth of about one-eighth of an inch. It extended entirely around the perineal wound, and was high up in the wound cavity, as could be seen. A distinct line of demarcation was noted about the eschar. This had the appearance of a line of vesication such as might have been produced by cantharidal collodion. On the twentieth day after the operation the eschar began to separate, and at the end of a week or ten days the wound was clean and granulating healthily. On the twenty-first day the fæces began to appear in the wound, coming apparently from a point very high up near the neck of the bladder. A few days later the urine began discharging by the rectum. On examination, a small area of sloughing was found to have developed in the rectum just below the vesical orifice. For a time a portion of the urine came through the urethra. After the perineal wound was thoroughly healed, there was no escape of fæces or gas through the urethra, but the entire quantity of urine was voided at regular intervals by way of the rectum. This has given rise to no special inconvenience, and the old gentleman is at work on his farm and very little annoyed by his condition, save by the knowledge that it is abnormal. An attempt to repair the fistula in this case would not only be unjustifiable, but would certainly fail of success.

The *modus operandi* of the formation of fistulæ in the foregoing cases is not difficult to comprehend in the second case. The age and malnutrition of the patient and the destruction of the rectal wall by sloughing incidental to what was probably a streptococcus infection from the bladder are sufficient to account for the action. Incidentally, I would call attention to the striking similarity of this case to the old-time hospital gangrene. It is barely possible that in the first case the rectum was injured during the operation. If so, the injury resulted from pressure by retractor in the hands of my assistant. There was certainly no cutting or laceration of the rectum at my hands. Admitting that such cutting or lacera-

tion had occurred, the location of the fistula was so low down that it would at once have been noticed. It is possible that in packing the wound or giving enemata by the internes and nurses after the operation the rectum was perforated. I do not feel justified, however, in laying the blame to this quarter. In both cases the capsule of the prostate was so adherent to the overgrowth that considerable disturbance of the prostato-rectal space was necessary during the operation. In patients of a low grade of vitality, a slight bruising of the rectal wall with the operator's finger might result in the accident encountered in the two cases cited.

THE UNION OF UNUNITED FRACTURES OF THE NECK OF THE FEMUR BY OPEN OPERATION.[1]

BY LEONARD FREEMAN, M.D.,

OF DENVER, COLORADO.

In spite of the disability often accompanying ununited fractures of the femoral neck, the union of the fragments by open operation has attracted but little attention, although it is feasible and seems to give fairly good results. There are various reasons for this neglect, the principal one being that the condition is usually encountered in old people with poor resisting powers, so that an operation of such magnitude would be accompanied by more danger than would be compensated for by the advantages gained. This does not apply, however, to those who are younger and more vigorous and in whom the function of the limb is of paramount importance.

Notwithstanding the comparative rarity of fracture of the neck of the femur in the young and middle-aged, it is surprising how few of these operations have been performed. In the literature at my command, I have been able to find the reports of but thirteen cases, my own making fourteen; while most text-books mention the subject but casually, if at all. Out of these fourteen cases, the final results are given in but ten.

Although the operation was done by von Langenbeck as early as 1858, his patient dying of hospital gangrene, and was favorably spoken of by Trendelenburg at the German Surgical Congress in 1878, it remained for Loreta to report the first successful attempt some ten years later. In this country, Willy Meyer seems to have been the first to operate, in 1893.

THE CHOICE OF CASES FOR OPERATION is of great im-

[1] Read before the Chicago Surgical Society, May, 1904.

portance. It should be considered from three points of view, —age of the patient, resisting powers, and amount of disability.

Advanced age is a contraindication, although, if an individual were not too old and his general condition exceptionally good, operative intervention might deserve serious consideration. The greatest field, however, necessarily lies among the young and middle-aged, where operation is not only permissible, but strongly indicated.

The resisting powers deserve the most careful attention, but it should be remembered that they are sometimes better in the old than in the young. Chronic and acute derangements of various organs, particularly the kidneys and lungs, must be given due weight before recommending operation.

The amount of disability is an important factor and must of course be considered with reference to the age. A moderate limp without pain or undue loss of function would hardly be sufficient ground for operation, especially as some degree of shortening would be almost sure to remain; but if disability and suffering were pronounced, operation would be strongly indicated in favorable cases.

It is worthy of mention that at various times the open operation has been advised for recent fractures. The suggestion has not been adopted, however, by the great majority of surgeons, even in younger subjects in good physical condition, because the chances of obtaining satisfactory results by less severe and dangerous methods are too good to be disregarded.

OPERATION.—(*a*) *Incision.* Formerly the question of postoperative drainage was of so much importance that it led to the frequent choice of posterior incisions; but, now that more confidence exists in aseptic *technique,* preference can be given to the anterior incision, which seems to offer greater advantages. Access to the joint, even in heavy individuals, is adequate; no muscles or other structures of importance are divided or even endangered; the absence of a wound back of the trochanter lessens the risk of infection, and permits a



FIG. 1.—Jacobson.

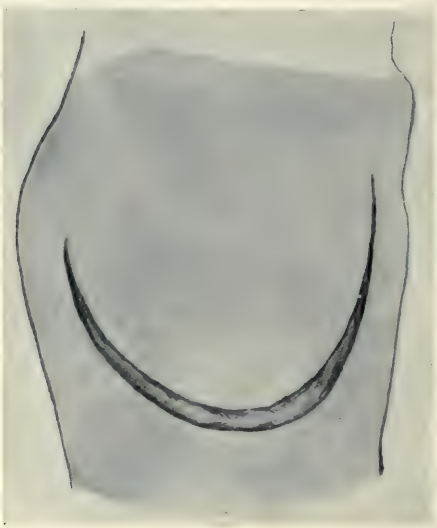


FIG. 2.—Gillette.

cushion to be placed behind the bone in such a way as to prevent its dropping backward, a point of considerable importance; and, lastly, the situation of the wound facilitates the after-treatment, including the removal of stitches, without the necessity of painful and troublesome turning of the patient.

The cut should begin a short distance below and external to the anterior superior spinous process of the ilium and extend directly downward for three or four inches, the exact distance varying somewhat according to the thickness of the soft parts. (Fig. 1.) It should lie just outside the sartorius muscle, which can be retracted inward, while the fascia lata is drawn outward. The dissection should be blunt as far as possible, especially at its lower extremity. Should the surgeon, during the course of the operation, conclude to remove the head of the bone instead of reuniting the fragments, he can do so through this incision quite as readily as through any other.

I can see no advantage in incisions which curve around the tip of the trochanter, and the resulting division of muscular attachments must at times be detrimental.

The osteoplastic operation employed by Gillette and Boeckman (*Transactions of American Orthopædic Association,* Vol. xi, p. 241), although ingenious and giving ample access to the part, seems uselessly complicated and severe, and in case of infection might lead to necrosis or to the existence of two ununited fractures instead of one. It consists of exposing the upper end of the femur by turning up a large horseshoe flap (Fig. 2), dividing the base of the trochanter with a chain-saw and turning it upward together with its muscular attachments. At the conclusion of the operation the fragment is replaced and held by a peg of bone.

(*b*) *Freshening of Fragments.*—This includes the removal of all interposed connective tissue, which, owing to the narrowness of the working-space, may be quite difficult and accompanied by considerable oozing, as in my own case. This tissue is very tough, and cannot be scraped out, but must be cut away with scissors.

The surfaces of the fragments, which are usually abnormally soft, are easily chipped away with a chisel or scraped off with a curette, care being taken to remove as little bone as possible in order to avoid shortening of the neck and, as a consequence, shortening of the entire limb, which is apt to be considerable in spite of all precautions. Troublesome oozing may be checked by the use of pressure-sponges wrung out of very hot water. Detached splinters of bone should be removed.

(*c*) *Fixation of Fragments.*—This is an important and difficult problem. From lack of fixation came the original pseudarthrosis, and upon the degree of its attainment may depend the ultimate results. Whatever method is adopted, the trochanter should be supported from behind, as it has a marked tendency to drop backward, thus producing displacement of the fragments and outward rotation of the limb. This can be done by a cushion or by an appropriate plaster-of-Paris dressing.

It cannot be denied that simple extension, combined with trochanteric support, would be sufficient to secure union in many instances; and, in fact, I am convinced that the results in a number of reported cases have been obtained by these means alone. This is more easily understood when we remember that union has failed in many instances, not because extension has failed, but because the seriousness of the injury was not recognized and extension was not employed.

It is perhaps unwise, however, to trust to extension alone, even when combined with support of the trochanter by a plaster cast surrounding the pelvis, because there are other procedures supposed to be more certain in their results. The principal one of these is the union of the fragments by means of nails, screws, or bone or ivory pegs. These may be inserted obliquely from the incision used in opening the joint, or more advantageously through a small separate opening over the external surface of the trochanter, which permits of better fixation and more easy removal. This method of holding the frag-

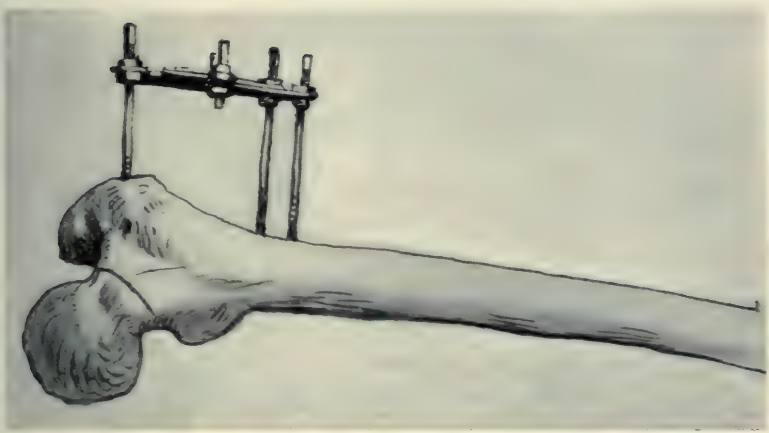


FIG. 3.—Parkhill's fixation apparatus.

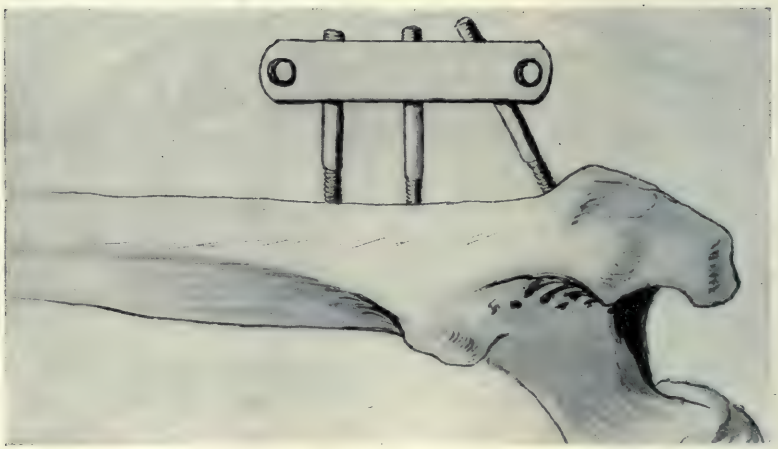


FIG. 4.—Method of securing screw in fracture of neck of femur; the wooden plates embracing screws

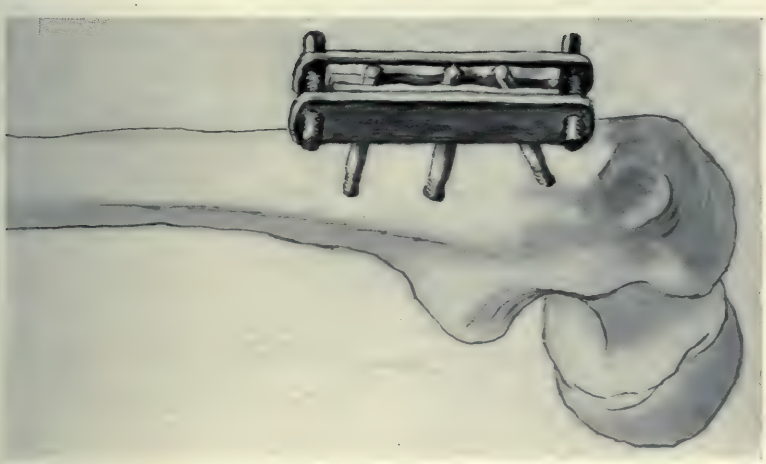


FIG. 5.—Completed screw and clamp apparatus for fixation of fracture of neck of femur.

ments is supposed to accomplish three things,—fixation, coaptation, and stimulation of bone formation.

Without special consideration, it would appear that perfect immobility of the pieces of broken bone could always be obtained by nails, pegs, or screws, especially the last mentioned. But this is not true, although it seems to have been taken for granted by all operators and writers, the reason being that the upper end of the femur often becomes so extremely soft and porous that the instruments of fixation will not hold. In my own case, and it has been noted by others, this softening was so marked that the screw could be pushed directly through the bone without previous drilling, the union being thus rendered so insecure that a very moderate degree of force was sufficient to reproduce displacement.

In order to obtain thorough fixation, Clayton Parkhill suggested the use of his well-known bone-clamp (ANNALS OF SURGERY, 1898, Vol. xxvii, p. 560); although, so far as I know, the suggestion has never been put in practice. This clamp is so constructed, however, that if the upper leg were inclined upward, as it would have to be, it would be very hard to fasten the wings of the apparatus together. (Fig. 3.) This difficulty may be easily overcome by making use of a much more simple and equally effective clamp which I devised some time ago and successfully employed in two cases of ununited fracture of the tibia. It consists of three or four long screws, which are inserted in a longitudinal line of holes drilled in the bone, their projecting ends being tightly held by two metal side-clamps lined with strips of wood. The efficiency of the apparatus lies in the fact that the screws bury themselves in the wood as firmly as if screwed into it. As regards the hip, it would make no difference at what vertical angle the upper screw projected from the bone, it could be easily adjusted and securely held. Such an apparatus, having its foundation two or three inches down the shaft of the femur, in solid bone, would certainly be more satisfactory than screws alone. (Figs. 4 and 5.)

The use of absorbable bone or ivory pegs is alluring be-

cause they can be left permanently in the tissues; but as a means of fixation they are less reliable than the methods already mentioned, and in case of infection, which may occur in spite of every precaution, they are difficult to remove. Wiring the fragments, although hard to accomplish properly in such deep-seated structures, would probably be preferable.

It is questionable whether two loosely fitting pegs or screws, passing through soft bone, are in any way superior to one; and the greater the number, the greater the traumatism and the chances of infection. When a bone-clamp is employed as described, one screw would appear to be sufficient.

The insertion of a coil of wire between the ends of the broken bone for a few days only, as was done by Loreta, would seem to have no theoretical justification, although in his case a good result was obtained.

When to remove the screws is a difficult question. They should remain, if possible, for several weeks, until consolidation is well advanced, unless infection occur, when they should be taken out at once. In my own case, as in one reported by G. G. Davis, fever appeared at the end of the second week. The removal of the screws, which were surrounded by infective material, caused a rapid subsidence of the symptoms.

(*d*) *Drainage.*—Temporary drainage of the wound is indicated, although depending somewhat upon the amount of oozing. When an anterior incision has been employed, I cannot believe it is wise to incise the tissues and drain posteriorly, because of the inconvenience of turning the patient in order to change the dressing, and because of the increased likelihood of infection.

(*e*) *Length of Time in Bed.*—This has been placed by the majority of operators at about ten weeks, although both Müller and Gillette permitted patients to get up in six weeks without apparent detriment. The longer time, however, must certainly be safer, because of the softened condition of the bone and its lack of adequate circulation.

RESULTS.—These have been, on the whole, encouraging. Nearly all operators have reported good motion and satisfactory function, although it must be acknowledged that some of the cases were not followed a sufficient length of time. There always remains, however, some shortening, varying from half an inch to an inch and a half or more. This arises from absorption of bone, from loss by freshening the fragments, and from imperfect adjustment; but it is usually not great enough to become a large factor in the final result.

WRITER'S CASE.—A heavy, muscular man, thirty-two years of age, injured the right hip by falling on it, May 2, 1903. He was up on crutches in about four weeks, the extent of the injury not having been recognized. When I saw him on September 23, 1903, he was still unable to use the limb in walking, owing to pain in the hip and knee. There was shortening of two and a half inches with a corresponding elevation of the trochanter, although this could easily be overcome by traction, the manipulation being accompanied by indistinct crepitus.

Operation (October 10, 1903, about five months after the injury).—Anterior longitudinal incision external to the sartorius, through which the neck of the femur was readily exposed, and the fracture located near the head of the bone. With difficulty a mass of tough fibrous tissue was snipped with scissors from between the ends of the fragments, which were freshened on each side of the gap with a chisel. A small incision was then made over the trochanter externally, and a hole for the reception of a screw drilled through the base of the trochanter, the external fragment of the neck, and into the head of the bone. The "drilling," however, proved to be a mere form, for the bone was so soft that the blunt screw could have been pushed directly through it without the boring of a preliminary hole. When the screw was in place, its outer end projected between the stitches used in closing the wound. Owing to the softness of the bone, the parts, although receiving considerable support, were far from being firmly held, so that it was possible to displace them with moderate force by rotating the limb or pushing it upward.

On account of oozing, it was necessary to pack the wound with a strip of gauze, which was removed in a day or two, the

opening closed, and primary union obtained. Extension, a long side-splint, and a pad beneath the trochanter were employed. For several days the suffering was great, necessitating the constant use of morphine.

In a week or so a little infection appeared about the opening, through which projected the screw, which at the end of about two weeks caused a rise in temperature to nearly 104 degrees, accompanied by chills and much general disturbance. On removal of the screw, however, these unfavorable symptoms promptly subsided, showing that they were probably due to infection of the cancellous structure rather than the joint (Davis reports a similar experience). The subsequent recovery was rapid and uninterrupted.

The extension was removed in about eight weeks, and the patient permitted to use crutches in ten weeks. Much callus could be detected, and there was about one inch shortening. In the face of various tests, the union seemed to be sound and bony.

When the patient left the hospital at the end of twelve weeks, he could bear his weight upon the limb without yielding at the seat of the fracture, and there was satisfactory movement in the joint as regards both flexion and rotation. I examined this patient again a little over six months after the operation, and found the following condition: union apparently firm, considerable callus, flexion to nearly a right angle, rotation almost normal, and about one and a half inches shortening. There was still enough pain in the joint anteriorly to prevent the patient discarding his crutches, although it was much less than before the operation and was decreasing constantly. When not attempting to walk, the weight could be borne upon the limb with but little, if any, discomfort.

Hence, up to the present time this case has not been a complete success, the result being marked improvement only. What the ultimate outcome will be is yet to be ascertained.

Other Cases.—(1) Von Langenbeck, in 1858 (*Charité Annalen*, 1858), operated upon an ununited fracture of the neck of the femur by incision and screws, death occurring from sepsis and hospital gangrene.

(2) Loreta (*British Medical Journal*, August 25, 1888). Man of thirty-six; fracture at capsular junction nineteen months previous to operation. Long incision behind trochanter. Fragments freshened by scraping. Attempted to wire fragments, but failed, and simply placed a

bundle of wires between them, which was removed in five days. Primary union. Able to walk in fifty-five days.

(3) W. Müller (*Samm. klin. Vortr.*, No. 145, 1896, p. 929). Woman of fifty-four. Injury two and a half years previous to operation. Anterior longitudinal incision external to sartorius. Fracture in centre of neck. Freshened fragments with chisel. Drill inserted obliquely through fragments from anterior wound and left in ten days. Extension. Out of bed in six weeks. Complete consolidation in twelve weeks. At end of three and a half years could walk several hours without inconvenience. Perfect motion in joint.

(4) W. Müller (*Samm. klin. Vortr.*, No. 145, 1896, p. 429). Mere mention of a case operated on in a similar manner to the one reported above. Results not given.

(5) Willy Meyer (Annals of Surgery, 1893, Vol. ii, p. 30). Man of thirty-nine. Injury ten months previous to operation. Langenbeck incision. Employed two long nails inserted through special opening over trochanter. Bone very soft. Extension eight weeks. In bed ten weeks. Bony union and good result.

(6) R. H. Sayre (*Transactions of American Orthopædic Association*, 1898, p. 247) mentions operating upon an ununited fracture of the neck of the femur in a man who had received the injury some months previously. "Incision as for resection of hip." Fragments united by a gimlet which was left in eight weeks. Good union and good functional result.

(7) A. J. Gillette. Operation by E. Boeckmann. (*Transactions of American Orthopædic Association*, 1898, p. 241.) Man of thirty-six. Injury six months previous to operation. Through a horseshoe incision the trochanter was divided at its base and turned upward, together with its muscular attachments. Bone pegs were employed to reunite both the fragments and the trochanter. Silica spica dressing. Primary union. In bed sixteen weeks. On crutches ten days. At end of a year was walking without a cane and with satisfactory motion of joint.

(8) A. J. Gillette (*Ibid.*). Woman of twenty-three. Injury fourteen months previously. Operation similar to above, except ivory pegs were used. Primary union. In bed eight weeks. At end of about one year there was one inch shortening, normal motion, and good function.

(9) Man of thirty-six. Injury six months previously. Operation similar to above. Primary union. In bed six weeks. Result,—a little over one inch shortening, relief from pain, slight limp, able to do manual labor at end of one year.

(10) G. G. Davis (*University Medical Magazine*, September, 1900). Man of thirty-eight. Injury one year previous to operation. Anterior longitudinal incision external to sartorius. Fragments freshened by gouge and curette and united by two long steel drills passed through a separate incision over trochanter. At end of two weeks temperature went to 105 degrees, with chills, fever, and sweats. Pins removed in three weeks, when septic symptoms ceased at once. Extension and fixation then applied. Up and about in ten weeks with apparently firm union and

good functional results. On March 29, 1904, Dr. Davis writes me that the fragments "again became loose after some months, and I inserted two large (three-inch) silver-plated wood screws. This hip was firm over two years after the operation, and has, I presume, remained so, or I would have heard from the patient."

(11) G. G. Davis (*Ibid.*). Man of thirty-five. Injury six months previous to operation. Anterior longitudinal incision external to sartorius. Intracapsular fracture. Through incision over trochanter, two ivory pegs, three and two-fifths inches long, driven through fragments. Plaster dressing from waist to below knee. Primary healing. Bony union apparently and good functional result. Dr. Davis writes me (March 29, 1904) that the fracture "has become somewhat loose from the subsequent breaking or loosening of the ivory pegs."

(12) W. W. Keen (mere mention of unreported case in letter from G. G. Davis). A three-inch, steel, silver-plated screw employed. Result good at end of three and a half months.

(13) G. G. Davis (private communication). Apparently firm union when case left hospital, but ultimate result unknown.

In addition to the above list, which is no doubt incomplete, F. Kammerer (Annals of Surgery, 1899, Vol. i, p. 624) alludes to a case of ununited fracture of the femoral neck in which he attempted to unite the fragments, but could not approximate them sufficiently. He accordingly abandoned the attempt and resorted to resection of the head of the bone instead.

An interesting case is also reported by M. Gangolphe (*Revue de Chirurgie,* 1899, Vol. ii, p. 763) which deserves mention, although it does not come strictly under the heading of this paper:

Man, aged thirty-nine. Injury eight months previous to operation. Intracapsular fracture with splintered neck. Divided trochanter, turned its base inward and united it to the freshened upper fragment of the neck. After union had taken place, a bony support was obtained, against which the shaft of the femur rested. At the end of three years (*Revue de Chirurgie,* 1901, Vol. ii, p. 585), the patient could walk long distances and carry heavy loads.

THE TREATMENT OF FRACTURE OF PATELLA.[1]

WITH REPORT OF RESULTS AFTER ARTHROTOMY AND SUTURE.

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My purpose in the present paper is to record my own personal experience in seven cases, being the total number under my care during the past nine years, one of which was treated by the non-operative plan by a posterior splint and strapping; the other six by the direct open method with wiring of the fragments.

The operative treatment of this condition has an historical value quite apart from the benefits which may follow it. In pre-antiseptic days any attempt at an operative treatment of fracture of the patella, which included opening the joint, had been followed in the majority of cases by disastrous destruction of the joint, even to amputation of the thigh, and death from pyæmia. Lord Lister endeavored to impress the truth of his opinions in regard to the antiseptic treatment of wounds by operating upon a series of fractures of the patella by the open method, and demonstrated by the success of his cases that it was possible to perform this operation with comparative safety.

He was not, however, the first to perform the operation according to his own method; Dr. Hector Cameron, of Glasgow, a former house surgeon of Lord Lister, did so on March 5, 1877, leaving the ends of the wire projecting through the wound, and drainage into the joint. Although bony union

[1] Read at stated meeting of the Montreal Medico-Chirurgical Society, April 1, 1904.

was not obtained, the parts were closely approximated, and the patient recovered with a useful limb.

Lord Lister's first case was in October of the same year, the details of the operation being the same as in Dr. Cameron's case. His second case was two years later.

On October 29, 1883, Lord Lister [1] delivered before the Medical Society of London an address on his experience to that date, which included seven cases, six of which he was able to bring before the Society. At this time he claimed that these cases demonstrated the success of his method and its easy accomplishment, providing no disaster occurs. Before commencing his first operation, he remarked to those about him that "No man was justified in performing this operation unless he could say with a clear conscience that he considered himself morally certain to avoid the entrance of any septic mischief into the wound."

Fracture of the patella may be divided into three classes, as follows: First. Indirect, or those due to muscular violence, a tear. Second. Direct violence, a blow. Third. A combination of the two, a tear and blow.

When this fracture occurs by muscular contraction the knee-joint is usually slightly flexed, bringing the articular surface of the patella, at about its centre, in contact with the head of the femur, producing a transverse fracture, dividing the patella into two fragments, the upper one most frequently the larger of the two. After the bone fractures, strong muscular contraction continues, producing a wide lateral tear in the aponeurosis.

Again, the fracture may be by direct violence, from the patient falling, the patella coming in contact with some hard substance, producing an irregular fracture, usually stellate, this involving the lower third of the bone. In this class of injury the damage to the aponeurosis may be very slight, occasionally an irregular laceration with one or more independently punctured wounds is seen. There is frequently no lateral laceration. Sometimes there is a combination of these two conditions, as in Case III of my series.

This third form occurs, first, by muscular contraction, the pain and loss of function permitting the patient to then fall to the ground, producing the above-mentioned condition; that is, there is a transverse fracture; a wide laceration of the aponeurosis; and one or more independent irregular tears involving the lower and anterior aspects of the aponeurosis.

This latter condition must be reckoned with in any operative measure to be considered, on account of the severe contusion to the soft parts, producing more or less hæmorrhage and resulting blood-clot, and greater interference with the blood supply, the whole tending to produce necrosis of the soft parts.

In the first class there are two points of importance: First. The wide laceration of the aponeurosis involving the lateral aspects, permitting wide separation of the fragments. This laceration usually occurs at a point below and parallel to the fracture, permitting the upper free portion to fall into the joint cavity between the fracture surfaces. This has been especially pointed out by Macewen [2] [3] and more recently by König.[4]

Second. Tilting forward of the fragments so that the fracture surfaces point away from the cavity. The displacement of the upper fragment is due to muscular contraction drawing more on the anterior than the lateral aspects, and in the lower fragment it is probably due to loss of support, permitting the fragment to fall downward, and possibly also from pressure of blood-clot and serum within the cavity. In several of my cases the large amount of blood-clot seemed a sufficient explanation in itself for the tilting forward of the lower fragment. In the second class there is usually little or no separation of the fragments owing to the absence of the transverse laceration, but there is, as above mentioned, much more contusion to the soft parts in the vicinity. In addition to the subcutaneous injury from contusion, the surface with which the patient comes in contact in his fall may produce serious injury to the skin, including wounds leading down to the injured bone, converting the injury into a compound or

complicated wound. In the third class the combination of conditions is of importance, as, bearing on the future treatment, the contused condition of the lower part of the aponeurosis and the numerous hæmorrhages are an additional element of danger should the open method of treatment be followed. The normal blood supply to the patella is limited, and in fracture, particularly where the lateral aspects are involved, this is much interfered with, and has been thought to play some part in the difficulty in obtaining bony union. In all cases there is more or less acute synovitis accompanied by effusion.

The treatment is divided into non-operative and operative, and this latter further divided into early and late cases. If a non-operative treatment is followed, we must expect that a complete return of function cannot be obtained. There is always inability to completely control the movements of the limb. The patient is unable in many cases to undergo the fatigue of long walking or climbing, and in most cases there is an inability to control the limb in walking down hill, and particularly in walking down stairs. Although there may be close approximation of the fragments at first, there is a tendency to continued separation, and during the middle adult years while the patient may notice little difference in the affected limb in carrying out the ordinary daily duties, as age creeps on and muscular tone lessens, the muscular control diminishes; exercise produces fatigue, and in a moment of emergency the limb will not respond, thereby permitting a fall which may be the cause of serious injury to other parts of the body. On the other hand, if operative interference is permitted, it can only be carried out in chosen cases, especially those cases where there is transverse fracture with wide laceration of the aponeurosis.

The operation is called for more particularly in cases of the first and third classes of those above mentioned. It should be recommended only in persons under fifty years of age, in good general health, who are free from alcoholic taint, and not the subjects of constitutional or organic disease.

Occupation should also be considered. Persons who lead a sedentary life suffer less from the disability resulting from the non-operative treatment than those engaged in active work. A practical clinical feature demonstrating the necessity for operation is the ability of the patient to extend the leg. (There was total inability to extend the leg in all my cases.) Mikulicz [5] refers to this as a guide, at the same time pointing out that pain may prevent movement where the quadriceps is still intact. He operates in classes one and three, but not in class two unless there is some exceptional reason. He practises the transverse incision, using the brass wire instead of the silver as formerly, on account of its great strength.

Powers [6] contributes an exhaustive article, in which he records the opinions of seventy-one surgeons, a summary of which shows that four would use Malgaigne's method, seventeen are opposed to operation, nine would operate unless there were distinct contrary complications, forty-one would operate in selected cases, such as wide separation and comminution.

In more recent literature I think the tendency is to operate more frequently.

Of the non-operative measures: Approximating of the fractured bone by strapping and a posterior splint has been long practised, and apparently meets the indications in certain cases. Malgaigne's hooks and its various modifications are not now in as much favor as formerly, although they are still used to some extent in France. The method of Tilanus, introduced in 1885, sometimes called the "Dutch method," consists of the following (I quote from Powers [6]): "During the first twenty-four or forty-eight hours the limb is elevated and the joint compressed by an elastic bandage. On the second or third day massage is commenced. The upper fragment is fixed by the fingers of one hand, while with the other gentle pressure is made from the knee along the thigh muscles. Massage is carried out for from eight to fifteen minutes twice daily. In the interval the fragments are held in position by straps of plaster, and the limb is so elevated that the extensors of the thigh are relaxed and the return of function favored.

Passive motion is begun early. The patient should be up and about on crutches by the eighth or tenth day."

Of the operative methods: The objection to the so-called subcutaneous method is that at best the parts are only brought into apposition and held there, and there is the same uncertainty as to the final result as in any of the non-operative methods. In addition, there is the danger of infection through the cutaneous wound. Of these the method of subcutaneous suture of the aponeurosis above and below the patella was originally practised by Butcher.[7]

Barker's operation[8] consists in passing a heavy silver wire completely around the fractured bone from before backward through small incisions in front of the joint. The wire is passed round by means of a special needle suggested by Mr. Barker, and the suture left permanently in. Of Barker's operation I have no personal knowledge, but the wonderful success which the author has obtained commands our respect.

In Kocher's operation the wire is temporarily passed behind the fractured surfaces and tied on a pad, where it is left for from two to three weeks and then withdrawn.

The objections which have been offered to both are that a full view of the parts is not obtained; that the fracture surfaces are not inspected; that the blood-clot is not removed from the joint; that the torn aponeurosis is not removed from the fractured edges; that a foreign substance is left adjacent to the articular surfaces of the patella and passing through the front of the joint; and that the passing of the needle through the joint in introducing the wire is not without some danger.

Of the open method: There are four different incisions practised. First. The linear perpendicular incision about three inches long, having its centre opposite the fracture line. Second. The semilunar incision with convexity upward. Third. The semilunar incision with convexity downward. Fourth. The semilunar incision with convexity inward.

Of these the linear incision has now been superseded by the semilunar. Of these the second, in my opinion, is apt

to interfere with the return of circulation and lead to some œdema, or even necrosis, of the flap. (This was seen in Case II). Of the third: I have followed this in my recent cases and have found it satisfactory. The objection that it is apt to leave a scar opposite the tuberosity of the tibia can be overcome by having the transverse portion of the incision above this point.

I have no experience of the fourth. It has been practised by my colleague, Dr. Armstrong, who considers that it lessens in a measure the interference with lateral circulation. This flap is lifted and the parts beneath are brought into view; the fracture surfaces cleansed of any intervening tissue and blood-clot, and brought together either by a single suture through drilled openings, or by two lateral sutures. These sutures may be of wire, silk, chromicized catgut, or kangaroo tendon.

The advantages of this open method are that it permits at once of a complete inspection of the field of operation; an accurate knowledge is obtained of the fracture or fractures in the bone, and the extent of the laceration of the aponeurosis. It permits of the free removal of blood-clot from the joint cavity, and of the approximation of the fractured surfaces, more particularly permitting one to see that the fracture surfaces are free from all intervening tissue. In considering the disadvantages, one must admit, in view of published statistics, that even in the hands of careful operators disastrous results have followed. These, however, may possibly be explained. In the first place, I think it must be admitted that the operation should never be performed except in the hands of fairly experienced operators who are surrounded by a technique with which they are familiar, and that it should only be done in selected cases, especially where there is bulging of the synovial sac at the end of a week or ten days' observation, during which period the limb has been elevated and appropriate local treatment carried out, such as an ice-bag applied to the knee. (This distention of the sac was present in all my cases.) When it is possible to recognize tilting forward of the fracture surfaces, and where there is separation of the fragments with inability

to extend the leg. In late cases, where there is wide separation of the fragments and marked loss of function after a fair trial of the usual non-operative measures.

In my series I have met with all the above conditions, more particularly the laceration of the aponeurosis at a point below the fracture line in the bone, permitting a curtain-like band of thinned-out, shreddy tissue, in one case as much as two inches, to fall towards the centre of the joint and between the fracture surfaces. In each case that this was noted, this fringe was closely adherent to the upper fragment intimately mixed with more or less organized blood-clot requiring active curetting of the fracture surfaces before the bone could be properly exposed. The amount of blood-clot found within the joint, even in late cases, was also somewhat of a surprise to me. The claim that this can be removed by aspiration or by a trochar I am not able to concur in. How much of it would be ultimately absorbed it is impossible to say. It is fair to assume, however, that portions of it become organized and play an important part in the development of adhesions, and it is admitted that it is a danger in recent cases should infection be threatened. I have found firm, hard clots occupying the anterior part of the joint cavity and separating the fracture surfaces that were with difficulty removed. In dealing with the danger of infection: I think too much importance has been attached to this accident as applied to wiring the patella, and too little to the same accident as seen in other fields, notably in operations involving the peritoneum. It must be admitted that not infrequently, at the hands of skilled surgeons surrounded by well-tried operating-room technique, the accidental infection of the peritoneum in doing an interval appendectomy or an exploratory laparotomy is seen with fatal results. It is held that this infection may come from the air as well as from some fault in the technique. These accidents are unfortunate whenever they happen, but I question if it is fair to condemn one operation without condemning all. Without operation, although a fairly useful limb is obtained, it is never perfect; the individual is at a disadvantage throughout the rest of his

life. In the case of workmen, men having to carry heavy weights, the loss of function is frequently progressive, often incapacitating the subject from following any of the ordinary laborious occupations; on the other hand, one is able to get such complete restoration of the function by operation that it is impossible for an ordinary observer to recognize any defect, as in Cases I, IV, and V. Bahr [9] reports that in an analysis of forty-four old cases, 35 per cent. showed complete disability so far as gaining a livelihood was concerned. On the other hand, in a favorable case which terminates satisfactorily, complete restoration of function of the limb is obtained; in some cases so perfect that the patient is unable to detect any difference, as in Case IV.

Regarding the time one should operate: My practice has been to allow the acute symptoms of synovitis and injury to the surrounding tissues to subside, this usually taking from a week to ten days. This, however, may be an unnecessary precaution, many preferring to operate as soon after the accident as possible, notably Watson Cheyne.[10]

After-Treatment.—A light posterior splint for a week or two, after which time the patient should be up and about, using crutches or a stick. At the end of four weeks all dressings should be removed, except a light protective bandage. Massage and passive movement should be carried out after the removal of cutaneous sutures, that is, after ten days. If the wire suture should cause any superficial irritation, it may be removed after six weeks by a small incision with the aid of local anæsthesia. (In none of my cases has this been necessary, although I may have to do it in Case VI.)

In my series the following points of technique were particularly observed:

The operation was done quickly. Rubber gloves were used. As soon as the joint was opened, sterilized gauze saturated in normal salt solution was carefully packed into the cavity. Continuous irrigation with salt solution was kept up. The only foreign substance, other than the gauze, introduced at any time during the operation was a forceps, or curette, to

lift out blood-clot. Special care was taken in adjusting the torn aponeurosis, particularly in getting careful apposition on the lateral aspects. The postoperative treatment included elevation of the whole limb. Early massage and passive movement.

I append an analytical digest of the histories of the seven cases which form the basis of the present communication.

CASE I.—M. C.; male, twenty-four years; plumber. *Date of Injury.*—June 4, 1895. *Nature of Violence.*—Direct. *Diagnosis.*—Transverse fracture, separation of one-half inch. Marked synovitis. *Operation; Days after Injury.*—Fifty-six days. Delayed a few days owing to pustular dermatitis due to blister plaster having been applied before coming under our notice. *Incision.*—Median linear. *Condition found.*—Of bone: Stellate fracture upper fragment, two-thirds of whole, fracture surface of lower facing forward. Of soft tissues: Large transverse rupture of aponeurosis, mass of fibrous tissue between fragments. *Suture Material.*—Silver wire at first introduced but broke, and was finally replaced by five strands of silkworm gut through one centrally drilled opening. *Approximation of Fragments.*—Impossible until a silk suture was passed through aponeurosis above and below patella and tied. *Postoperative Treatment.*—Plaster of Paris for six weeks. *Result at Present Date.*—Complete restoration of function; has been regularly at work since three months subsequent to operation. Recent radiograph shows perfect bony union. (Fig. 1.)

CASE II.—H. R.; male; twenty-nine years; delivery driver. *Date of Injury.*—November 20, 1902. *Nature of Violence.*—Indirect and direct (fell on knee after he heard and felt the break). *Diagnosis.*—Transverse fracture, low down; marked synovitis; severe injury to superficial soft tissues. *Operation; Days after Injury.*—Eleven days. *Incision.*—Semilunar, convexity upward. *Condition found.*—Of bone: Transverse fracture upper fragment three-fourths of whole, fracture surface of both fragments facing forward. Of soft tissues: Large oblique rent extending from a point about two inches below fracture line on inner side to edge of fracture on outer side. Fringes of this, two inches long, hanging over fracture surface of upper fragment. *Suture Material.*—



FIG. 1.—Radiograph showing result of suture of fractured patella (Case 1).



FIG. 2.—Result of patella suture (Case II).



FIG. 3.—Fracture of patella; condition before suture (Case III).



FIG. 4.—Fracture of patella; condition before suture (Case IV).

Single silver wire through centrally drilled openings. *Approximation of Fragments.*—Easily brought together. *Postoperative Treatment.*—Plaster of Paris for about six weeks. *Result at Present Date.*—Superficial suppuration from original damage of soft parts, synovitis present for some weeks. Some months later, while adhesions were being broken down under ether, patella again fractured, partly through old fracture line and partly below. Posterior splint and straps at once applied for six weeks. Good union without separation. Patella freely movable; movement of joint is now normal; has been driving laundry delivery regularly and with comfort. Recent radiograph shows that bony union is not complete, a small fissure being present close to the anterior aspect; this is probably due to the second fracture. (Fig. 2.)

Case III.—J. McN.; male; thirty-three years; laborer. *Date of Injury.*—August 24, 1902. *Nature of Violence.*—Probably direct. *Diagnosis.*—Transverse fracture, treated with strapping and posterior splint; unable to walk at end of four months; separation of three-fourths of an inch. *Operation; Days after Injury.*—One hundred and twenty-nine days. *Incision.*—Semilunar incision, convexity downward. *Condition found.*—Of bone: Transverse, two-thirds in upper fragment, lower fragment facing forward. (Fig. 3.) Of soft tissues: Thin fibrous band connected separated fragments. *Suture Material.*—Silver wire through two laterally drilled openings. *Approximation of Fragments.*—Easily brought together. *Postoperative Treatment.*—Plaster of Paris for five weeks. *Result at Present Date.*—Man has been regularly at work and reported that he was perfectly well. Have been unable to get recent radiograph.

Case IV.—F. L.; male; fifty years; carpenter. *Date of Injury.*—December 19, 1902. *Nature of Violence.*—Direct. *Diagnosis.*—Transverse fracture. *Operation; Days after Injury.*—Sixteen days. *Incision.*—Semilunar incision, convexity downward. *Condition found.*—Of bone: Transverse one-third in upper fragment, both fracture surfaces facing forward. (Fig. 4.) Of soft tissues: Aponeurosis torn below line of fracture; upper portion lying between fragments in numerous bands and threads. *Suture Material.*—Silver wire through one centrally drilled opening. *Approximation of Fragments.*—Easily brought together. *Postoperative Treatment.*—Plaster of Paris about three weeks. Massage and passive movement at end of third week. *Result at*

Present Date.—Complete restoration of function. Radiograph shows bony union. (Fig. 5.)

CASE V.—T. L.; male; forty-one years; stonemason. *Date of Injury.*—November 22, 1903. *Nature of Violence.*—Direct. *Diagnosis.*—Well-marked transverse fracture, synovitis. *Operation; Days after Injury.*—Eight days. *Incision.*—Semilunar incision, convexity downward. *Condition found.*—Of bone: Transverse, with comminution of lower fragment, three-fourths in upper fragment. (Fig. 6.) Of soft tissues: Aponeurosis torn below line of fracture, upper portion lying between fragments in numerous bands and threads. Large blood-clots in joint cavity. *Suture Material.*—Chromic catgut suture through laterally drilled openings in upper fragment; passed between comminuted lower fragments out through the patellar ligament; reintroduced and passed between the bone and aponeurosis on extreme lateral aspects and out through aponeurosis to a point close to top of opening in upper fragment and tied. *Approximation of Fragments.*—Easily brought together. *Postoperative Treatment.*—Posterior splint and elevation of thigh for a few days. Early massage and passive movement. *Result at Present Date.*—Gradual return of function; patella freely movable; no pain. Have been unable to get recent radiograph.

CASE VI.—E. C.; male; twenty-two years; laborer. *Date of Injury.*—December 29, 1903. *Nature of Violence.*—Indirect. *Diagnosis.*—Transverse fracture; marked synovitis; separation three-fourths of an inch. *Operation; Days after Injury.*—Thirteen days. *Incision.*—Semilunar incision, convexity downward. *Condition found.*—Of bone: Transverse fracture. (Fig. 7.) Of soft tissues: Aponeurosis torn below line of fracture, upper portion lying between fragments in numerous bands and threads. Large blood-clot in cavity. *Suture Material.*—Silver wire through two laterally drilled openings. *Approximation of Fragments.*—Easily brought together. *Postoperative Treatment.*—Posterior splint and elevation of thigh for a few days, followed by early massage and passive movement. *Result at Present Date.*—Walked without assistance or support in two weeks; complete return of function. Recent radiograph (Fig. 8) shows shadow produced by new bone.

CASE VII.—J. B.; male; thirty-two years; beer-bottler. *Date of Injury.*—October 10, 1902. *Nature of Violence.*—Indirect. *Diagnosis.*—Transverse fracture; slight separation; marked



FIG. 5.—Final result after suture of fractured patella (Case IV).



FIG. 6.—Comminuted fracture of patella (Case V).



FIG. 7.—Fracture of patella; condition before arthrotomy and suture (Case VI).



FIG. 8.—Fracture of patella; condition after suture (Case VI).



FIG. 9.—Showing skin cicatrix in Case VI twenty-eight days after operation.



FIG. 10.—Fracture of patella, recent; treated by non-operative measures (Case VII).

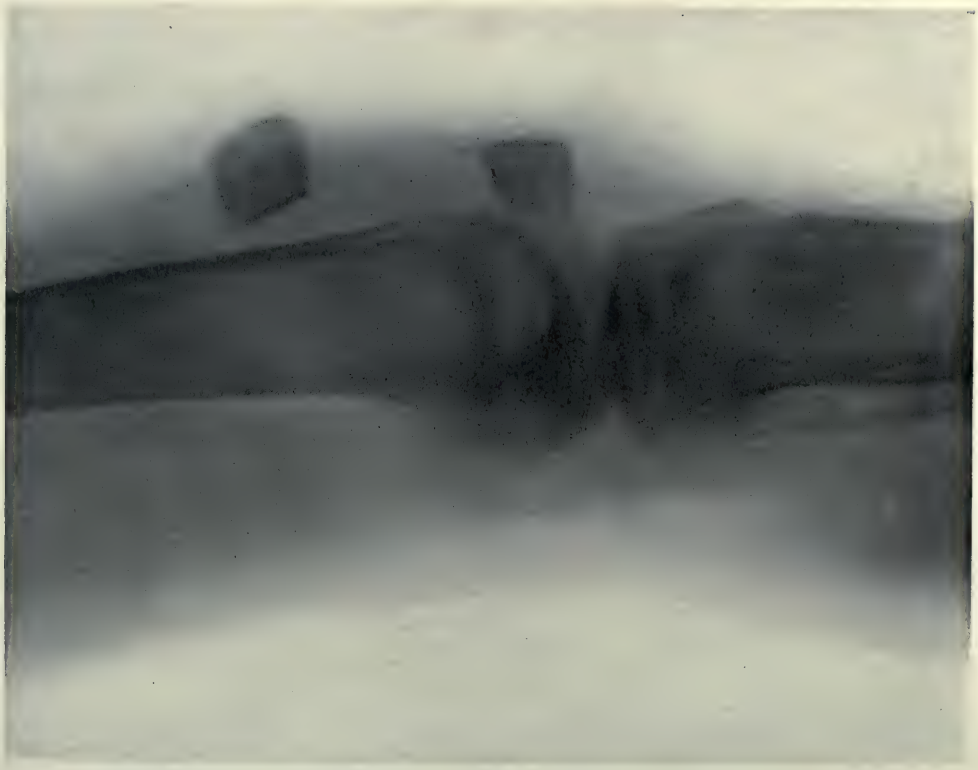


FIG. 11.—Ultimate result in Case VII, treated by non-operative measures; limb extended.



FIG. 12.—Ultimate result in Case VII, treated by non-operative measures; limb flexed.

synovitis; eversion forward of lower fragment; crepitus easily elicited. *Treatment.*—Strapping, posterior splint, elevation of leg, massage. *Result at Present Date.*—Separation of fragments in repose about two and a half inches (Figs. 11 and 12), function good. Walks with some lameness, and is unable to control limb in stepping down from an elevation, as in walking down stairs.

Of the six cases operated upon all walked without lameness, and are able to go up and down stairs without any noticeable difficulty. The one case that showed lameness, namely, that unoperated upon, was unable to step down from a chair, although he has what is called a good result.

My thanks are due to Mr. W. P. Watson, director of the X-ray laboratory of the Montreal General Hospital, for the excellent radiographs he has supplied.

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[10] Cheyne and Burchard, Part 3.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting, May 11, 1904.

The President, HOWARD LILIENTHAL, M.D., in the Chair.

MULTIPLE RESECTION OF INTESTINES IN CHILD SIX AND ONE-HALF YEARS OLD; POSTOPERATIVE OBSTRUCTION, WITH A THIRD ANASTOMOSIS; RECOVERY.

DR. JOHN F. ERDMANN presented a boy, six and one-half years old, who was admitted to Gouverneur Hospital on February 30, last, about 9 P.M. The history obtained was that some time between six and eight o'clock that evening he was run over by a wagon, the wheel or wheels passing from the anterior superior iliac spine of the left side upward and obliquely across the abdomen. A contusion about three inches long by an inch and one-half wide was seen in the vicinity of the left anterior superior iliac spine.

At 4 P.M. on the following day, when Dr. Erdmann first saw the patient, his temperature was 101.2° F.; pulse, 128. The abdomen was rigid and distended; there was pain on palpation. The patient had vomited; his bowels had not moved.

Through a median incision, a tear two inches long was found in the left peritoneal layer of the mesosigmoid. Further search revealed a mass of intestine, fully ten inches long, from which the mesentery was torn off, leaving a triangular gap with a base of about four and a half inches. The mid-portion of this section

contained a gangrenous area about one by two inches in size. A second section of the intestine, in close proximity, was found with a triangle of its mesentery ecchymotic and gangrenous. The base of this was fully two and a half to three inches long. The intestine supplied by the vessels of this portion of mesentery, about five and a half to six inches long, was gangrenous in several small areas, and at each end of the destroyed mesentery the intestinal loop had a peculiar, cordlike constriction. These two sections of intestine were excised and anastomosed with Murphy buttons. The abdomen was then closed without drainage, the entire operation taking forty minutes.

The boy's reaction to the operation was favorable. The first button was passed on the ninth and the second on the twentieth day. About the fifteenth day, the patient's abdomen began to swell and his countenance became anxious. There was total obstruction for twenty-four hours, when he again began to improve, and continued to do so until the 28th of March, when some of his family smuggled fruit and cake to him, of which he ate his fill, and which was followed by profound obstruction, tympany, and vomiting. The abdomen became rigid and painful; pulse, 140.

On March 30 the abdomen was again opened, and it was found that a complete separation had occurred between the ends of the formerly apposed and anastomosed sections. A pouch or walled-off pocket of about two inches long and fully two and a half inches in diameter was present, and by reason of overdistention this ruptured and permitted of sufficient leakage of intestinal contents to create the peritoneal manifestations. Owing to adhesions, it was impossible to bring these separated ends into the abdominal wound. They were thereupon anastomosed laterally by dropping one-half the button into each end, then taking a purse-string suture about each end fully three-eighths of an inch away from the free edge, and inverting the open end. As the sutures were drawn tight, the button halves were forced together by nicking the gut over the stem of the female half, and then forcing the male stem, covered by the intestinal wall, into it. The cavity was wiped out, a small drain placed in the vicinity of the anastomosis, and the wound sutured. The patient began to improve immediately, and had entirely recovered by May 1. The third button was passed ten days after its insertion.

STONE IN THE PELVIC URETER (FEMALE).

Dr. George E. Brewer presented a woman, forty-three years old, who was admitted to Roosevelt Hospital in the autumn of 1903. Fourteen years before she first experienced an attack of pain in the lower left abdomen; this attack lasted six days. Five years later she had a similar attack lasting twelve hours. This time the pain radiated to the groin and thigh, and there was a sense of numbness in the external genitals on the same side. Since that time she had had about a dozen similar attacks, with more or less constant discomfort in the flank and groin. In one of these attacks there was moderate hæmaturia. Three years ago she underwent an operation on the left ovary, which was followed by a period of relief for several months. The pain, however, recurred, and during the past two years it had been at times severe and compelled her to give up her work.

When the patient was admitted to the hospital she had an extensive ventral hernia at the site of the previous operation. There was moderate tenderness over the left kidney at a point two inches below and to the left of the umbilicus, in the neighborhood of the external abdominal ring, and, by vaginal examination, in the left half of the roof of the pelvis. These points of tenderness varied somewhat on different occasions, and at times none but the kidney tenderness could be elicited. The urine was cloudy, containing a faint trace of albumen and considerable pus. While in the hospital she had an acute attack of colic, the pain radiating to the groin and thigh, but without hæmaturia or evidences of hydronephrosis. An X-ray examination of the kidney was negative. The attack of colic was so characteristic, however, that an exploratory operation was advised.

Under ether anæsthesia, a generous oblique incision was made in the flank, exposing the kidney and upper part of the ureter. The kidney was incised, the finger passed into its pelvis and every calyx explored, with negative result. A flexible, metallic ureteral sound was passed into the ureter and could be introduced to the wall of the bladder; beyond that point it could not be pushed. There was no feeling of a foreign body touching the sound, its failure to pass into the bladder being apparently due to stenosis of the ureteral orifice rather than to obstruction by a calculus. To verify this, however, the incision was extended

to the inguinal region, and the ureter followed down with the finger to its junction with the bladder. As no stone could be felt, and as the injection of a solution of methylene blue into the pelvis of the kidney immediately appeared in the bladder urine, further search was abandoned. The wound was closed by layer sutures, a small cigarette drain being left, extending to the kidney incision.

The wound healed kindly, and several weeks later the patient submitted to an operation for the cure of the ventral hernia. While she was still in bed from the latter operation, another attack of colic occurred similar to those she had experienced before. After her recovery from the last operation, another X-ray picture was taken obliquely through the pelvis, which showed the presence of a calculus in the lower end of the ureter. The patient refused further operative treatment and was discharged from the hospital. Three or four months later she experienced an attack of acute, left-sided pain, accompanied by chills, fever, and sweats. During the attack, the region of the left kidney was exquisitely tender; the kidney was apparently enlarged from distention of its pelvis. This attack subsided in about one week. Two or three weeks later she was readmitted to the Roosevelt Hospital.

Under ether anæsthesia, the urethra was dilated until it admitted the forefinger. With this the region of the left ureteral opening was palpated, and a small, oval calculus distinctly felt beneath the mucous membrane. The bladder was then distended with ten ounces of sterile salt solution. The bladder was opened above the pubes and its walls retracted with three large abdominal retractors. A bent probe passed through the left ureteral orifice touched the stone. The orifice was then slit up for a distance of a quarter of an inch, the stone readily seized with the forceps, and withdrawn. After thorough irrigation, the bladder was closed tightly with three layers of chromicized catgut, the other structures approximated, and the cutaneous wound partly closed with silk. A small gauze drain was left, extending to the cavity of Retzius. The patient was catheterized every two hours for the first three or four days. The wound healed kindly; there was no leakage; the patient had since been entirely free from pain.

STONE IN THE PELVIC URETER (MALE).

DR. BREWER presented a man, thirty-four years old, who was admitted to the Roosevelt Hospital in March, 1904. When he was eight years old, he experienced an attack of right-sided colic, the pain radiating from the flank to the groin, glans penis, and testis. Since that time he has had many similar attacks. At thirteen years of age he had a very severe attack, which lasted five days and was accompanied by the passage of red urine. Eleven years later he had another severe attack which lasted six days. In none of these attacks was there any apparent swelling in the region of the kidney. Three years ago an X-ray picture taken of the kidney region was negative.

Up to one year ago the patient was under the care of Dr. George K. Swinburne, of this city, who informed Dr. Brewer that the urine had always been clear and free from any evidence of renal or bladder infection. Shortly after this the patient visited a dispensary, where a sound was introduced for purposes of exploration. This was immediately followed by an acute infection of the bladder, and since that time the urine had never been free from pus. Six months ago the right kidney was explored at the City Hospital. No stone was found, but, as the kidney was somewhat movable, nephrorrhaphy was done. No relief followed this procedure, and during the past five months the patient had suffered more or less constant pain in the right inguinal region, chiefly located at a point near the external abdominal ring. Three days ago he experienced another severe attack, which was so acute in character that he was unable to sleep, and for two days he rolled about on the bed and floor, screaming and vomiting. The urine was albuminous and turbid from pus. There was slight tenderness over the kidney and ureter, more particularly over its lower portion. An X-ray examination revealed the presence of a stone in the pelvic ureter, near the spine of the ischium.

Under ether anæsthesia, a curved incision was made about two inches about Poupart's ligament, and the muscular layer divided until the peritoneum was reached. This was retracted inward and stripped from the side wall of the pelvis, freely exposing the iliac vessels and ureter. The ureter was easily followed into the pelvic cavity, and the stone was found about one inch below the brim of the pelvis. Above this point the ureter was

dilated to the size of the forefinger and considerably thickened. The stone was easily pushed upward to a more healthy portion of the ureter and extracted through a small, longitudinal incision. This incision was then tightly closed with a single row of fine, chromicized catgut sutures. Over this was placed a mass of subperitoneal fat, which was also sutured to the ureteral wall. After this the parts were allowed to fall into place and the wound united by layer suture. A small cigarette drain was left in the lower angle of the wound, extending to the subperitoneal space.

The patient's recovery was uneventful. There was no leakage. He was discharged on the twenty-fifth day after operation.

Dr. Lilienthal said that he had a case under his observation at present in which the symptoms pointed to the presence of a stone in the pelvic ureter. A few days ago, after an injection of indigo-carmine in the gluteal regions, both ureters were catheterized. The urine drawn from the left side, where the symptoms were practically *nil*, escaped freely and contained plenty of coloring matter. On the right side, where the kidney was rather large and movable, very little urine escaped, and this contained scarcely any coloring matter. This was probably due to the fact that the kidney on that side was not secreting. One of the symptoms that had led to the suspicion of stone was hæmaturia. X-ray pictures of both kidneys failed to show the presence of stone.

Dr. Brewer said that about a year ago he saw a case in which the X-ray disclosed the presence of a ureteral calculus. In spite of severe and repeated attacks of colic, the patient refused operation. One night, during such an attack, he drank two quarts of Poland water within an hour, and after another hour of excruciating pain the calculus was spontaneously expelled.

About eight weeks ago, Dr. Brewer said, he was called to see a young woman who was supposed to have appendicitis. She was having a good deal of pain, which was located exactly over the external abdominal ring. He decided that the case was not appendicitis, and advised against operation. Six weeks later he was again called to see her. He was still convinced that the case was not one of appendicitis, but, as the pain had lasted about two months, an exploratory operation was deemed justifiable. The patient was sent to the hospital and an X-ray picture taken, which revealed a stone in the ureter, and thus cleared up the diagnosis.

ADENOMA OF AN ACCESSORY THYROID, CAUSING MARKED TRACHEAL STENOSIS.

Dr. Brewer presented a man, fifty-two years old, a physician, who first came under his observation in the latter part of March, 1904.

Some three years ago, on exertion, he first noticed slight difficulty in breathing. He attributed this to lack of exercise and progressively increasing body weight. Some months later it was noticed that there occurred occasional attacks of rather pronounced dyspnœa, always following some unusual exertion. Believing that the trouble was asthmatic in character, his treatment consisted of the usual remedies for this condition. During the past six months the difficulty in breathing had greatly increased, the dyspnœa becoming almost continuous. At certain times it was intense, and would be accompanied by cyanosis. This so interfered with his work that he at last consulted Dr. Francis J. Quinlan, of this city, who on examination with the laryngoscope readily detected a very decided encroachment upon the caliber of the trachea by an oval mass apparently springing from the right half of the tracheal wall. This tumor was smooth, oval, and covered, apparently, with healthy mucous membrane. It left a semilunar tracheal aperture about a quarter of an inch in diameter. The patient was also seen in consultation by Dr. Holbrook Curtis, who verified the diagnosis and referred him to Dr. Brewer for treatment.

In addition to the above findngs, Dr. Brewer noticed a very slight bulging at the root of the neck, to the right and just above the sternoclavicular articulation. On deep palpation, a hard, oval mass was felt extending into the mediastinum. Moderate pressure on this mass caused an immediate increase in the dyspnœa, and a greater degree of pressure produced absolute tracheal obstruction. From these findings, the diagnosis was made of an extratracheal tumor, producing a marked indentation of the right wall of the trachea.

As a course of potassium iodide had already been tried without any improvement, an immediate operation was advised.

During the following four or five days, while the patient was arranging his affairs preparatory to entering the hospital, the dyspnœa was markedly increased. He was unable to lie down, and on the night before entering the hospital his symptoms were

so urgent that a brother physician passed the night in his house administering oxygen and stimulants freely. On the following afternoon he was again seen at the hospital by Dr. Brewer, in consultation with Drs. Quinlan and Curtis. The symptoms were so urgent at this time that it was decided to operate immediately, as it was feared he could not survive until the following morning.

In view of the alarming dyspnœa and the difficulties of the operation, it was decided to intrust the anæsthetic to Dr. Thomas L. Bennett, who promptly responded and administered chloroform. The patient at first took the anæsthetic kindly, but as soon as the position of the head was changed to allow the performance of a preliminary tracheotomy, the dyspnœa became extreme, with grave cyanosis.

An incision was made in the median line from the cricoid to the suprasternal notch, and thence continued downward towards the right in a curved direction for about three inches. The tissues overlying the trachea were rapidly divided and retracted, until the isthmus of the thyroid was exposed. This occupied practically the entire space between the cricoid and the sternum, and was exceedingly voluminous and vascular.

Considerable delay was caused by the application of a number of mass ligatures, so that the thyroid tissues could be divided to expose the trachea. While this was in progress the patient ceased to breathe and the skin became livid. As the cut surface of the thyroid was bleeding profusely, it seemed unwise to make an attempt to open the trachea, which was pushed well to the left by a large, encapsulated tumor which lay beneath the thyroid gland, partly within and partly above the mediastinum. About a minute and a half were consumed in arresting the hæmorrhage, during which time the respiration was completely arrested. As soon as the hæmorrhage was controlled, an incision was made into the trachea, and an attempt made to introduce a tube. Owing to the narrowness of the lumen, only the smallest-sized infant tube could be introduced. Respiration was at once re-established, and the patient's color improved. The thyroid and other tissues were gradually dissected away from the tumor, which was found to be completely encapsulated, and to lie closely adherent to the trachea, the œsophagus, the recurrent laryngeal nerve, the jugular and innominate veins, and the innominate artery. About one hour was consumed in dissecting the tumor free from these structures,

after which the wound was partly closed; a large drain was left in the middle third, with the view of keeping the wound open and exposing the tracheal wall for subsequent X-ray treatment in case a histological examination revealed any signs of malignancy.

The patient's recovery was prompt, and, aside from a short period of iodoform poisoning, it was uneventful. Laryngoscopic examination showed a paralysis of the right vocal cord, but a great increase in the lumen of the trachea. The vocal paralysis was undoubtedly due to division of the recurrent laryngeal nerve. On examination, the tumor proved to be an adenoma, probably of an accessory thyroid, and it showed in places slight changes suggesting carcinomatous degeneration.

Dr. F. Kammerer said that surgeons who had much experience with thyroid tumors could well appreciate the difficulties of an operation like the one described by Dr. Brewer, especially when hæmorrhage and dyspnœa were present at the same time, and the question arose which of the two to attend to first. The situation thus created was one of the most trying surgeons could meet with. Years ago, when the speaker saw cases more frequently, it was considered a very dangerous procedure to do a tracheotomy in connection with extirpation of the thyroid gland. The former should only be done when all other attempts to relieve dyspnœa had been exhausted. The large wound cavity was liable to be infected after opening the trachea, and therein lay the danger.

Dr. Kammerer said that as long as a malignant tumor of the thyroid did not perforate its capsule, the prognosis was relatively good. He recalled one such case, a large, encapsulated malignant tumor, in which the patient lived for a period of twelve years. When perforation and carcinomatous infiltration of surrounding tissues had occurred, the outlook was very unsatisfactory.

Dr. Francis J. Quinlan (by invitation) said that when the patient shown by Dr. Brewer first came under his observation, which was several weeks prior to the operation, he presented all the symptoms of one who was suffering from stenosis of the larynx or trachea. The laryngoscope revealed the cause of the dyspnœa. The trachea had the appearance of a funnel struck by a hammer. Although there was no reason to suspect syphilis, the patient was given a thorough course of specific treatment, without resulting benefit. Macroscopically, the tumor removed by Dr. Brewer looked like an enormous sarcoma.

Dr. Brewer said that while the supposition was that this was an adenoma of an accessory thyroid, it was evident that the thyroid was separate from this distinctly encapsulated tumor. It was easily peeled off and separated. Its lower part was fibrous in character. The speaker said his impression was that it was one of those thyroid masses which grew in the wall of the gland, and yet were distinct from the thyroid itself.

CALCULI IN THE COMMON DUCT; CHRONIC CHOLANGEITIS; CHOLECYSTECTOMY AND CHOLEDOCHOTOMY.

Dr. Charles H. Peck presented a man, aged fifty years, who was referred to him, March 22, 1904, by Dr. L. O. Monory. The man had been ill for about three years with pains in the upper abdomen, chills, fever, sweating, slight jaundice, and loss of flesh and strength. For a long time he had been under treatment in Philadelphia, where he had consulted a number of physicians, but obtained only temporary relief. He came to New York in November, 1903, and had been more or less constantly under treatment. While not confined to bed, he was too ill to attend to his work. The chills, fever, and attacks of pain occurred frequently, but without regularity; usually at intervals of from one to three days. The chills were often severe, lasting from twenty to thirty minutes. The pain was variable in character and duration, often lasting several hours. Icterus slight and variable.

While the patient was in Dr. Peck's office he was taken with a severe chill, which lasted about twenty minutes. His temperature immediately afterwards, taken in the mouth, was 102° F.; pulse, 112. On examination, there was an area of increased resistance in the region of the gall-bladder, but the mass could not be distinctly outlined. There was moderate tenderness and rigidity; otherwise, abdominal palpation was negative. Slight icterus. Leucocyte count, 17,000.

The patient was admitted to the French Hospital on March 29, 1904. He had had no chills during the preceding week, and the pain and tenderness have subsided considerably. Leucocyte count, 11,000. Operation, two days later, under ether anæsthesia. The region of the gall-bladder was exposed through a five-inch incision, vertical through the right rectus, then oblique towards xiphoid. The gall-bladder was buried in dense adhesions, small and thick-walled, firmly attached to the transverse colon. Chole-

cystectomy was done by the Lilienthal method, with a traction suture of chromic gut through the cystic duct, and a clamp above it at the base of the gall-bladder. A perforation on the under surface of the gall-bladder was exposed on separating it from the transverse colon, and a small quantity of bile escaped, the dense adhesions having prevented previous leakage. The viscus measured less than two inches in length; its walls were greatly thickened; its cavity much contracted. A small amount of thin pus was found in a closed pocket at the fundus.

The stump of the cystic duct was now drawn up by the traction suture, and a greatly dilated common duct exposed, in which a movable stone could be felt. With scissors, the stump of the cystic, common, and hepatic ducts were freely slit open; both the hepatic and common ducts were much dilated, readily admitting the forefinger. A large stone was felt high in the hepatic duct and removed with forceps; another was removed from the lower end of the common duct, where it had acted as a ball-valve. A probe was passed into the duodenum, and no other calculi were found. A small drainage tube was passed well into the hepatic duct and fastened in place by two fine, chromic gut sutures, placed laterally, as suggested by Mayo. A single chromic gut stitch was then taken in the common duct below the tube, and, after cleansing, three cigarette drains were placed in Morrison's space down to the duct. The abdominal wall, excepting at the point of drainage, was closed.

The patient reacted well from the operation, and his bowels moved in response to an enema at the end of forty-eight hours. Bile drained freely through the tube in the hepatic duct until the third day, when the tube was removed. Subsequent to this, bile escaped from the wound in constantly diminishing amount until the twenty-second day.

There was no recurrence of pain, chills, nor fever after the operation, and convalescence was uneventful, with the exception of a slight separation of the upper end of the wound, which was caused by the patient's getting out of bed about the sixth or seventh day. This caused some delay in the closure of the abdominal wound. The patient left the hospital on May 3 practically well.

Dr. Lilienthal thought the method followed by Dr. Peck was superior to that suggested by Mayo in a recent issue of the

New York Medical Record. In cholecystectomy by the latter method, the beginning was made in the cystic duct, and ligation was practised with the idea that there would be less hæmorrhage. The speaker said he did not think the hæmorrhage was apt to be severe; certainly not until the cystic duct was reached. What bleeding there was came from the liver. The disadvantage of the method was that one then had the cystic duct sealed, and if it became necessary to proceed with work on the common duct, another operation, choledochotomy, would have to be done.

Referring to the small size of the gall-bladder in Dr. Peck's case, Dr. Lilienthal said that the small gall-bladders were usually more difficult to take out than large ones.

Dr. Peck, in closing, said that this was the first time he had attempted a cholecystectomy by this particular method. The hæmorrhage was easily controlled. The chief difficulty was in separating the adhesions from the transverse colon and liver. The hepatic and common ducts were so large that they could be easily followed, and with the finger the stone could be palpated. The readiness with which the widely opened hepatic and common ducts closed upon suture was particularly gratifying. The closure was continuous, and complete in about three weeks, although they had been laid widely open for a distance of over two inches.

NEPHRECTOMY FOR SARCOMA.

Dr. Charles N. Dowd presented a girl, six years old, who was admitted to St. Mary's Hospital on March 28, 1904. Her family and previous personal history was unimportant, and the child was in good health until six months before her admission, when she began to have pain in the left hypogastrium and left lumbar region. She frequently felt nauseated. She first noticed a swelling in the left hypogastrium two months before admission. This had grown rapidly. She had lost much in weight and strength. Her urine had occasionally been dark-colored of late.

When the patient came to the hospital she was pale and emaciated. The heart and lungs were normal. The abdomen was greatly distended and the superficial veins much dilated. A tense, elastic, smooth tumor could be felt within the abdomen, extending from the diaphragm into the left part of the pelvis, pushing back into the lumbar region and across the median line in front for two or three inches. Its general outline was globular; it was

very slightly movable. The urine was of a specific gravity of 1028; acid; it contained no albumen, blood, casts, nor sugar. The leucocyte count was 13,000.

March 30, an oblique incision was made, beginning at the twelfth rib at the margin of the quadratus lumborum above the anterior superior iliac spine, and extending across to the median line below the umbilicus. The peritoneum was incised for about four inches. The tumor was only slightly adherent to the surrounding tissues, and was enucleated with little difficulty and very slight hæmorrhage. The ureter and renal vessels were ligated separately. The peritoneal wound was closed with catgut, the fascia with chromicized gut, and the skin with silkworm gut, with a small silkworm-gut drain. Convalescence was prompt and uneventful. There was a free secretion of urine, of good quality, from the start.

Pathologically, the tumor proved to be a sarcoma of the perithelial type, originating within the kidney capsule, probably from the outer coating of the blood-vessels. It seemed not to be of adrenal origin.

The pathological report by Dr. Frank S. Mathews was as follows: "The tumor lies beneath the kidney capsule, and between it and the kidney parenchyma. On section, the tumor is found to consist of cells, spindle or polyhedral, sometimes arranged in rows, with a small amount of stroma between them. The masses of tumor cells are arranged around a central blood-vessel. These vessels often have a wide lumen, and do not show the usual number of coats, but the tumor mass of cells seems to take the place of adventitia.

"The striking features of the tumor are its relation to the blood-vessels, and the rows of cells extending radially from the central blood-vessels. Sections at the junction of the tumor and renal parenchyma show the tubules and tufts compressed but not infiltrated with tumor tissue. In other places, the kidney tissue remains practically normal. The diagnosis is perithelioma, or perithelial sarcoma."

Dr. Dowd said the case illustrated the ease with which these sarcomata could sometimes be removed, even after attaining a large size. As bearing upon the prognosis and the ordinary operative mortality, the statistics collected by Dr. Waller, of Baltimore (ANNALS OF SURGERY, Vol. xxvi), were of interest. A careful

study of the recorded cases and a review of the histories of seventy-four operative cases showed that the operative mortality was 36.48 per cent. and the mortality within three years between 73 and 93 per cent. The percentage of cures followed beyond the three-year limit was 5.4 per cent. The life period was apparently increased 8.69 months by the operation.

Dr. Kammerer said he was surprised to hear that Dr. Dowd had experienced so little difficulty in developing such a very large tumor. In a similar case which the speaker reported about five weeks ago, signs of a recurrence had already become apparent. In that instance, great difficulty was experienced in raising the tumor above the crest of the ileum with the patient in the lateral position. Out of six cases that had come under his observation, the speaker said he had succeeded in extirpating the tumor in three. The three in which he had been unsuccessful were his earlier cases, and he had perhaps been too timid in his attempts, on account of the size of the growths.

Dr. Lilienthal asked Dr. Dowd whether he employed the Trendelenburg posture in operating on his case? In two cases that had come under his observation, he had been enabled to extirpate the growths without opening the peritoneum at all. In one of these the tumor was almost as large as the specimen shown by Dr. Dowd; in the other it was smaller. The Trendelenburg posture was employed in both instances, and seemed to facilitate the manipulations very much. The speaker recalled two cases of enormous sarcoma of the kidney that had been shown some years ago by Dr. Abbe, who emphasized the importance of this position in facilitating the work.

Dr. Kammerer said he thought the ideal posture in these operations was the lateral position. Personally, he would attack all these tumors from the retroperitoneum, opening the peritoneum, however, in order to assure himself as to the position of the ascending or descending colon. The colon was at times not recognizable to the touch, but when seen it could easily be stripped off to the inside of the growth.

Dr. Dowd, in closing, said that he had considered the use of the Trendelenburg position in this case, but thought that it would not have been an advantage. No great difficulty was experienced in removing the growth. The peritoneum laid over it like a fold, and would have had to be incised, no matter what the posture was.

PLASTIC OPERATION FOR THE RESTORATION OF THE LOWER LIP.

DR. F. KAMMERER presented an old man, whose entire lower lip had been involved in an epitheliomatous growth. In order to remedy the defect left by its removal, a quadrangular flap was removed from the cheek, carried down, and sutured to the remnant of the lower lip. The cosmetic effect of the operation was excellent. Dr. Kammerer said he thought this method was preferable to that of carrying a flap up from the neck, as the latter did not possess the advantage of an internal mucous surface.

REMARKS ON POSTOPERATIVE INTESTINAL OBSTRUCTION, WITH A REPORT OF THREE CASES.

DR. CHARLES H. PECK read a paper with the above title, for which see page 510.

DR. JOHN F. ERDMANN said he had seen several cases of postoperative intestinal obstruction. Three years ago he was called upon to relieve this condition in a boy who had been operated on in Brooklyn eight months previously for a suppurative appendicitis. When Dr. Erdmann saw him, he was suffering from profound intestinal obstruction. This was found to be due to an adhesive band. The cause of the obstruction was relieved, but the patient died from shock.

Four years ago he operated on a boy at St. Mark's Hospital. The patient had been running a septic temperature for several weeks, and had a large tumor in the right iliac region. This proved to be an abscess. This was evacuated, leaving an immense cavity, which required prolonged packing. It finally healed, and the patient left the hospital, refusing to submit to any further operative interference for the purpose of removing the appendix, from which the abscess had probably originated. Several months later he had an attack of intestinal obstruction, and died without operation.

The question of postoperative intestinal obstruction, Dr. Erdmann said, seemed to him to be largely one of prophylaxis. A movement of the bowels should be insisted on within twenty-four hours after the operation, and during each succeeding twenty-four hours. No morphine should be given; if any opiate is needed for the pain, codeia would usually be found satisfactory. Personally,

the speaker said, he had never had a case of postoperative intestinal obstruction, excepting in the abscess case reported above.

Dr. Brewer said he thought these cases were comparatively common. He had certainly seen six or seven cases of postoperative intestinal obstruction, three within the past year. One of these followed general peritonitis after an operation on the gall-bladder; one resulted from an abscess of the appendix, and the third occurred in a woman who had had eleven laparotomies performed for various reasons, most of them for intestinal obstruction. In that case, Dr. Brewer's laparotomy was the sixth time the patient's abdomen had been opened for intestinal obstruction. The intestines were everywhere matted together, and there were a number of distinct angulations. She recovered from that operation, but a recurrence of the condition was looked for.

Dr. Lilienthal was also of the opinion that intestinal obstruction following intra-abdominal operations was unfortunately very common. He recalled one case where he had operated for a ruptured liver abscess. The man had general peritonitis, from which he recovered. A year later he had intestinal obstruction, for which he was operated on too late and died. In two other cases coming under his observation, the intestinal obstruction followed operations for acute appendicitis.

Dr. Lilienthal said he did not think it was always possible to prevent the formation of adhesions. Some persons seemed to have an idiosyncrasy in that direction, and became subject to permanent adhesions more readily than others. Women seemed to be more subject to them than men. He had seen cases of so-called clean appendicectomy followed by adhesions. The speaker said he thought Dr. Peck had done a valuable service in emphasizing the fact that all cases of laparotomy should be watched for several weeks subsequent to the operation, particularly in respect to diet and the action of the bowels. These factors were too often neglected.

Dr. Dowd mentioned a case of intestinal obstruction in which he had assisted Dr. Henry C. Coe where the condition was the result of injections made by a quack for the cure of hernia. An enormous number of adhesions were found, producing tight occlusion of the intestine. The injections in that case must have been made into the peritoneal cavity.

Dr. Peck, in closing, said he particularly wished to empha-

size the importance of the after-treatment of laparotomy cases. If these patients were safely tided over the first six or eight weeks, the great majority of adhesions would have become absorbed by that time, and the danger of intestinal obstruction would be comparatively slight. As Dr. Lilienthal had suggested, some persons may be predisposed to the formation of permanent adhesions; but in the great majority of cases the obstruction occurred within the first two weeks, and many of them could probably have been prevented by proper attention to diet and the condition of the bowels.

TRANSACTIONS

OF THE

CHICAGO SURGICAL SOCIETY.

Stated Meeting, May 2, 1904.

The President, E. WYLLYS ANDREWS, M.D., in the Chair.

CARCINOMA OF THE CHEEK.

DR. NICHOLAS SENN presented a patient upon whom he had recently operated for an extensive carcinoma involving the left cheek. When admitted, the left cheek was the seat of an extensive swelling, in the centre of which was a perforation which communicated with the cavity of the mouth. Sections of curetting under the microscope showed it to be a case of unusually malignant form of carcinoma that had its starting-point somewhere about the alveolar process on the left side and involved the entire cheek. There was extensive regional dissemination, although the disease had lasted only three or four months. The submaxillary lymphatic glands were involved. In the absence of glandular involvement along the sheaths of the vessels of the neck, a radical operation seemed justifiable. The entire cheek was removed, leaving the angle of the mouth and a small portion of the cutaneous covering of the cheek. The periosteal covering of the lower jaw on the corresponding side was sacrificed together with the submaxillary gland and the whole chain of lymphatics. An enormous defect remained, which required a very extensive plastic operation to cover in. Owing to quite an extensive alopecia behind the frontal region, it was possible to utilize in this case a temporofrontal flap. A large flap was raised from the left temporal region, extending over to the frontal, and turned down and sutured into the wound, so that this lining of skin was a substitute for the lost mucosa of the cheek. A flap from the skin

of the neck was then formed and drawn up so as to cover the raw surface exposed. For the purpose of supplying this enormous flap with additional blood supply a flap from the scalp was laid over the base of the pedicle and another one from behind. The scalp defects were filled in at once with Thiersch's skin grafts. The circulation of the inner flap was satisfactory, and the large wound healed almost throughout by primary intention.

MULTIPLE TUBERCULAR ABSCESSES.

DR. SENN presented a man, forty-five years of age, who had been admitted to the Presbyterian Hospital with three large tubercular abscesses involving the left side of the chest. One of these ruptured spontaneously, and a fistulous opening communicated near the nipple, with a very large abscess cavity. Another abscess was found at the junction of the ribs with the cartilage near the sternum, and another to the left of the mammary line—three large, distinct tubercular abscesses, with no anatomical connection, as shown by the peroxide of hydrogen test. At operation the third, fourth, and fifth ribs were found to be the seat of tuberculosis. The reporter was obliged to resect the ribs in their entirety, a rule in practice to which there should be no exception, because tuberculosis of the ribs invariably means an antecedent tubercular perichondritis or a tubercular periostitis. Therefore, the tubercular product surrounding the ribs or perichondrium makes it necessary to use Koenig's incision, and to always resort to the resection of the rib in its entirety to reach the floor of the abscess, in order to follow the fistulous tracts which may communicate with other secondary tubercular foci.

In this extensive resection all of the large abscess cavities were scraped out and vigorously disinfected with peroxide of hydrogen, followed by a 3 per cent. solution of carbolic acid, and finally a 1 per cent. solution of iodine. Extensive primary drainage was instituted and continued for two or three days. Then the multiple wounds were sutured throughout, and ten days later all of these wounds had healed by primary intention.

ACUTE OSTEOMYELITIS.

DR. SENN presented a youth in whom a primary osteomyelitic focus had involved the internal tuberosity of the tibia. Although the disease was limited, the general symptoms were very

marked, all out of proportion to the size of the osteomyelitic focus. There was no tendency of the disease to extend to the shaft of the bone, but at a comparatively early stage, owing to the proximity of the osteomyelitic focus to the knee-joint, secondary synovitis set in, which unquestionably added to the acuity and intensity of the disease. A copious effusion formed, but after the removal of the osteomyelitic focus by early operative intervention, the synovitis soon subsided; the general symptoms became more mild, but in the course of a few weeks the patient complained of pain in the left elbow. The external condyle of the humerus was the seat of a secondary osteomyelitic process. The disease in the humerus pursued a very mild course. No swelling of any size made its appearance. Tenderness, however, remained for a number of weeks. He exposed this secondary osteomyelitic focus, relying almost entirely upon the point of tenderness, by a curved incision, with its convexity directed downward, reflected the flap up to near the joint, and with chisel and hammer found a deep-seated abscess in the bone. He scraped out this osteomyelitic cavity, resorted to thorough disinfection by pouring into it, first, peroxide of hydrogen, and afterwards using a 5 per cent. carbolic acid, dried the cavity, and packed it with decalcified bone chips, and obtained healing through by primary intention.

After having been absent from the hospital for a number of weeks, the patient presented himself again with a central osteomyelitis of the inferior maxilla.

CYSTS OF THE DUCTUS THYROGLOSSUS.

Dr. Senn said that he had had to deal with three cases of cysts of the ductus thyroglossus in two weeks. The patients were all young subjects, eighteen to twenty-five years of age,—two females and one male. The cysts were comparatively small. They were located in the median line, between the thyroid cartilage and the base of the hyoid bone. The enlargement was slow; there were pain and swelling. The skin was movable in all of the cases over the surface of the swelling. Fluctuation was distinct. In all of them the cysts contained a white viscid substance, a little thicker in consistence than synovial fluid. The only operative procedure which promises a satisfactory result is excision. The slightest remnant of the epithelial lining remaining will invariably

give rise to prompt recurrence, so that excision must be practised with the utmost care. He succeeded in these cases in excising the cysts. In one the wall was thin, and he had to remove remnants of the cyst wall after he had removed the bulk of the swelling.

FIBROMA OF THE PERIOSTEUM.

DR. SENN presented a specimen of fibroma of the periosteum which had its starting-point from the periosteum of the second rib close to the cartilage. The tumor extended over the surrounding bony framework in mushroom-like manner and underneath the clavicle. The clinical history was somewhat obscure. The patient had a doubtful past. Very vigorous antisyphilitic treatment was at first resorted to without making any impression upon the size of the tumor or relieving the pain accompanying it. It was finally removed through a curved incision, with its convexity directed upward, and the flap reflected as far as the clavicle, thus laying bare freely the base of the tumor, which was found intimately attached to the periosteum of the second rib near the sternum. The tumor was very firm and smooth, and on making a section it cut almost like cartilage.

A second fibroma of the ribs, situated at the lower part of the scapula, he had removed recently from a woman, thirty years of age, who stated that she first noticed the tumor eighteen years ago. It was stationary for awhile, but gave rise to quite serious functional disturbance by fixation of the arm. On examination a tumor was found extending in the direction of the axillary space. He had great difficulty in laying this tumor bare. The surrounding muscles seemed to be implicated in the surface of the tumor. There was no encapsulation. Dull instruments were useless. By tedious dissection he laid the scapula bare up to near the neck, and then removed it with chain-saw.

VERRUCA SENILIS.

DR. SENN presented specimens removed from the face of a woman, seventy-one years of age, the subject of multiple senile warts or verruca senilis. The disease involved the malar eminence on both sides. There were a number of these warts scattered all over the face; those over the malar eminence were the seat of repeated irritations, and had undergone transformation

into epithelioma. Both of them had their starting-point in a pre-existing senile wart or verruca senilis.

GOUT SIMULATING MYOSITIS OSSIFICANS.

Dr. Senn presented a colleague upon whom he had operated twice before, once for a diffuse septic inflammation involving the right arm and forearm, and a second time for appendicitis. For a number of months he had complained of a vague pain in the right shoulder. He regarded it as a rheumatic affection; but local and general treatment failed to give him any relief. The pain increased in severity, and the shoulder-joint almost completely lost its function. An X-ray photograph revealed no indication of any swelling, but Dr. Senn found at a point corresponding to about the middle of the base of the deltoid there was a limited area of tenderness. On examining the photograph there can be seen at the centre of the deltoid muscle a dark elongated spot. The shoulder-joint itself is normal. The reporter considered the case on the face of this photograph one of myositis ossificans. The dark island representing bone tissue in the deltoid as it appears entirely separate from the greater tuberosity of the humerus. Acting upon this diagnosis, he laid the deltoid muscle bare by a curved incision, reflected the flap upward, and found, to his utter astonishment, the deltoid absolutely normal. In palpating the deltoid, he found at a point corresponding to the outer side of the bicipital groove of the greater tuberosity a rather hard swelling; he separated the deltoid vertically by the use of the director and came down to a hard mass, not bone, but underneath the periosteum it appeared to be encapsulated. He incised and exposed a large mass of inorganic salt, sodium biurate. He scraped this out, and, to be sure he should make no mistake by leaving an undiscovered bone lesion, he chiselled away a little of the surface of the bone, which he found extremely dense. A process of condensation had taken place; the surface of the bone became compact at a point corresponding to this inorganic deposit. The diagnosis of gout now was plain.

LIPOMA ARBORESCENS OF THE KNEE.

Dr. Senn said that in the last four weeks he had had two cases of lipoma arborescens. In one case the patient was a young

man, college student, about nineteen years of age, athlete, who had recently become incapacitated because of a weak knee-joint. Dr. Senn made externally a long incision, explored the joint, and found the synovial membrane preternaturally vascular, but had considerable difficulty in locating the mechanical cause of this temporary loss of function of the joint. Finally, in examining closely the lower recess of the synovial sac corresponding to the space between the tuberosity of the tibia and the patella, an unusual prominence, so that by a certain movement of the joint the swelling would insert itself between the two articular surfaces, he uncovered that part of the synovial sac and found underneath it a very diffuse lipoma. The capsule was sutured to the external wound and the joint immobilized. Healing throughout by primary intention followed, with satisfactory restoration of the function of the joint.

The second case was a more pronounced one. The patient was a young girl suffering from the same symptoms, with temporary derangement of the joint in walking, so as to make the knee-joint partially useless. There was found a typical lipoma arborescens involving the opposite side of the synovial sac, implicating the patella, and extending up to the upper recess. There was a large, diffuse intra-articular lipoma. The entire synovial surface was very vascular, thickened, and it looked like a typical case of tuberculosis, of course. But strangely, in both of the cases there was no hydrops. Here he resected the entire synovial sac, treated the wound in a similar manner as in the first case, and the patient is recovering very rapidly.

THE UNION OF UNUNITED FRACTURES OF THE NECK OF THE FEMUR BY OPEN OPERATION.

Dr. Leonard Freeman, of Denver, Colorado, read a paper (by invitation) with the above title, for which see page 561.

Dr. Nicholas Senn said that the question of direct fixation of such fractures was not a new one. In the years 1882–83 he spent what little leisure time he had in a scientific study of the question. It was up to that time doubted whether union by bone under any circumstances could be obtained in cases of intracapsular fracture of the neck of the femur, and he presumed this was the anatomical seat (intracapsular) in Dr. Freeman's case. He produced this

fracture on the lower animals by drilling the neck of the femur in different directions and fracturing it, satisfying himself in each instance that he had not only produced a fracture, but it was inside the capsule. He treated twenty-three of the animals thus experimented upon by the methods of treatment then in vogue. He entertained the hope he would be able to prove that that method of treatment would succeed in obtaining bony union in cases in which the line of fracture was within the capsule of the joint. In all of these twenty-three cases he failed. He nearly despaired that he would be able to prove his position assumed at that time, that bony union was possible, and hence he had to resort to direct methods of fixation. Breaking the bone in a similar manner, he resorted to the use of ivory bone pegs and metallic nails. In ten experiments following twenty-three failures, in nearly all of them he could demonstrate that he had obtained bony union. He found, however, afterwards practically that the same results in the human subject were obtainable by indirect methods of fixation by bringing the fractured surfaces in contact and holding them there by lateral pressure by a splint of his own device. He had treated since that time fifteen or twenty cases, and in the majority of them he could demonstrate not only excellent functional results, but union by bony consolidation.

Dr. Senn said that, judging from the osteoporotic neck of the trochanter in Dr. Freeman's case, and the amount of shortening in the case, as well as the incomplete functional repair, he seriously doubted whether the bone had united by consolidation. It was always a question whether the method of fixation had anything to do in effecting such an ideal result. He doubted whether an ivory bone-nail, or any kind of nail, in such osteoporotic bone would hold the fragments in apposition. He did not think extension by weight and pulley could add anything to the functional result, because in aiming at bony union in cases of this kind it became absolutely essential to resort to immediate reduction at once and hold the fractured surfaces in mutual uninterrupted contact, something that could not be accomplished by extension with weight and pulley. He should imagine, as an additional mechanical aid, it would be preferable in cases of this kind not to rely on nailing the fragments, but to combine it with immediate fixation with a well-fitting plastic splint, with the limb slightly abducted, securing for the seat of fracture the necessary

degree of rest. He was sure a number of such operations had been performed, but the results had not been published because they were disastrous. It was necessary, in operating in such an important locality as the hip-joint, to see to it that, if it became necessary to vivify the fractured surfaces through an anterior incision to bring the parts in such a condition, the surgeon could close the wound throughout and obtain healing by primary intention without the dangers incident to drainage. The surgeon must be conservative in interfering with old fractures of the neck of the femur, because in some cases of non-union the functional results were excellent. It became a serious responsibility when one converted a subcutaneous fracture of the neck of the femur into an open wound, because surgeons had not reached that certainty in asepsis which entitled them to do so without making a very careful selection of cases. He questioned very much whether at present surgeons were warranted in resorting to the open treatment.

Dr. A. J. Ochsner referred to a paper read by Dr. Ruth before the American Medical Association in June, 1901. At that time Ruth showed a femur which had been removed from a patient who had been treated some years before. The specimen which Ruth showed seemed so satisfactory that some of the critics believed that the bone had not been fractured because it had united so well. However, Ruth gave measurements before and after the fracture, and to the speaker's mind the line of union was plain. He had followed the method described by Ruth after returning home, and had since used it in sixteen cases. The ages of these patients were 30, 37, 37, 43, 47, 53, 54, 57, 58, 60, 62, 66, 76, 78, 79, and 80. Two of them died, one of diabetic coma and the other one of exhaustion. There was union in all of them. The amount of shortening in all of them was less than three centimetres, which corresponded to the results obtained by Dr. Ruth and the observations he had made in a number of cases.

The principle upon which Ruth's treatment was based had been published and illustrated fully in the *Journal of the American Medical Association,* so that it was not necessary for him to describe it. He depended upon extension which was longitudinal, downward, and extension upward and externally, so as to produce internal rotation of the entire extremity and to elevate the great trochanter and overcome the external rotators. In all of the

cases the patient was anæsthetized upon admission to the hospital in order to confirm the diagnosis without giving too much pain. The extremity was placed in the corrected position; measurements were made before and after anæsthesia, and before and after the correction. The extremity was placed in the corrected position, and then the rubber adhesive plaster applied as directed by Ruth. This method was first introduced many years ago by Dr. Maxwell, of Keokuk, a colleague of Dr. Ruth's. Extension was applied downward; then a second broad rubber adhesive plaster was applied from a point on the anterior inner surface as high up as possible around the posterior surface of the thigh and out; and the speaker made use of a little device which consisted of adjustable posts made for weight and pulley extension, applied to the side as well as to the foot of the bed. He had found this very convenient. One of these frames was placed opposite the greater trochanter a little above it, and a weight varying from four to twelve pounds was attached to this pulley, which caused internal rotation, and another weight of eight to twenty-four pounds was attached to a second pulley at the foot of the bed, causing extension.

One of the beneficial results of the treatment was, that whereas formerly, when extension was made in a longitudinal direction, and a posterior or lateral splint applied, there was pain always, with this method but one of the sixteen patients had complained of severe pain, and this patient was so very hysterical that it was doubtful whether she had pain or not. It seems as though the use of this method would greatly reduce the number of ununited fractures of the hip.

Personally, he had made the open operation but once in a case in which the patient had a very painful hip, with ununited fracture. In this case he used two Parkhill screws through the neck and into the head; but the result was not satisfactory, and he had to remove the head afterwards. Union was primary, but there was so much callus as to cause pain. Possibly the traumatism was too great, due to the use of two screws.

Dr. Alexander Hugh Ferguson said he had had three cases of ununited fractures of the neck of the femur upon which he had operated.

The first was a man, fifty years of age, and the fracture was of three years' standing. Operation was done on account of pain

and lack of function. Patient was not able to do his work as a farmer. The head of the bone was removed through a lateral incision. Result was excellent. Patient was now able to work. There were nearly two inches of shortening.

The second case was a woman, with fracture of two years' standing. She was sixty years of age, and fractured her hip while riding a bicycle, having fallen upon the hard pavement. Operation was undertaken on account of inability to use the limb and pain. He removed the head of the bone, and obtained good functional result, with shortening of about an inch and a half. She was again able to ride a bicycle. He was surprised in this case at the soundness of the head of the bone. It was firm and hard. He felt sure that if he had brad-holed the seat of fracture and put an ivory peg through and fixed it with plaster of Paris, or something else, he would have gotten bony union.

The third case was a woman, twenty-six years of age, who was at present in the hospital, but about ready to leave. She was able to rest the leg on a chair and had good function in seven weeks. He removed the head of the bone on account of ankylosis of its head in the acetabulum. There was also a fracture of the head of the bone towards the acetabulum, which caused firm ankylosis at the acetabulum, and he thought, if he had fixed the neck with the rest of the bone, there would still be ankylosis.

His experience in these three cases had induced him to favor the open operation. His experience with non-union in other bones, where the surgeon brad-holed and opened down into them, wired the fragments, and put all sorts of rings or clamps around them, was that union did not take place even then, and the surgeon had to resort to the open method, put in live bone chips, or pack it with iodoform gauze, leave the cavity open, and let it heal from the bottom, and thus obtain firm bony union. He mentioned a case of fracture of the radius which he had last year, in which he resorted to the open method successfully. Other surgeons had used this method with success. He did not see why surgeons could not pursue the open method in connection with fractures of the neck of the femur in selected cases.

Dr. Freeman agreed with Drs. Senn and Ochsner that in recent fractures of the neck of the femur the open operation should be avoided; but in those fractures which were ununited, if one wished to get union, it was necessary to resort to the open

method. He did not think there was as much danger attending the open operation as Dr. Senn had intimated. Surgeons should use those measures which they thought under the circumstances would give the best results; whether it be the removal of the head of the bone, as suggested by Dr. Ferguson; whether the use of pegs of various kinds or wiring, or some such apparatus as Dr. Senn had used so successfully in recent fractures of the neck of the femur. There was not as much danger from the use of screws as Dr. Senn had led us to believe. Dr. Parkhill had used his clamp in fifteen or twenty ununited fractures of various kinds without bad results. Those who had employed the bone-clamp had observed that if infection did take place after its use, which was seldom, it did not occur for many days after operation had been done. The infection, if it occurred, would creep down slowly from the skin along the track of the screw, and by this time the hip-joint itself would be walled off from the screw track altogether by new tissue, lymph, etc. Hence infection would be along the screw into the cancellous tissue alone, as in his own case and that of Dr. Davis. He believed the stimulation of the screw through the bone was a great incentive to bony union. He thought Parkhill had fully proven in his reported cases in the Annals of Surgery that when reparative action failed by ordinary measures (wiring, etc.), that union was obtained at once by the use of his clamp. In no single instance did Parkhill fail with his clamp, nor has any one else to his knowledge who had used it.

CORRESPONDENCE.

ON THE VALUE OF POSTOPERATIVE GASTRIC LAVAGE.

EDITOR ANNALS OF SURGERY.

There are, to my mind, two valuable results to be obtained by the use of postoperative gastric lavage—(1) vomiting is prevented in a large percentage of cases, as pointed out by Dr. C. S. White in his article in the August number of the ANNALS OF SURGERY; and (2) the kidneys are relieved of the necessity of eliminating variable quantities of a substance capable of producing serious and even fatal inflammatory lesions. This latter point has not been brought out by Dr. White, and is, I believe, the more important of the two.

After operation, the excretory function of the renal apparatus should be at its maximum in order that the toxic products resulting (*a*) from *unavoidable* infection during operation and (*b*) from disease may be promptly eliminated. The smallest possible quantity of anæsthetic has been insisted upon by Simpson of this city with this idea in view. If, in addition, a portion of the ether it has been necessary to use can be removed from the body by washing the ether-laden mucus from the stomach, the tax upon the kidneys is still further diminished.

I have been using gastric lavage at the East End Hospital as a routine procedure after operation since October, 1902, and am convinced of its value. It is my intention to have made a stomach-tube with a diameter of seven or eight millimetres in order that it may be introduced through the nares instead of through the mouth, thus avoiding the use of the mouth-gag. The ordinary stomach-tube, however, is a necessity in cases in which there is doubt as to the presence or absence of solid food in the stomach.

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ORIGINAL MEMOIRS.

BACILLUS PYOCYANEUS SEPTICÆMIA ASSOCIATED WITH BLASTOMYCETIC GROWTH IN PRIMARY WOUND.

BY JOSEPH RILUS EASTMAN, M.D.,

AND

THOMAS VICTOR KEENE, M.D.,

OF INDIANAPOLIS.

THE rôle played by the bacillus pyocyaneus in the various pathologic conditions in which it is met has been subject to much discussion and debate. Some maintain that it exists merely as a saprophyte; others maintain, and the weight of recently accumulated evidence would seem to support this view, that it must be considered as a definite etiological factor capable of exciting very diverse morbid phenomena.

The bacillus pyocyaneus was discovered by Gessard in 1882. It was isolated from dressings soiled with so-called blue pus. He regarded it purely as a saprophytic organism which in itself was incapable of producing symptoms in man. In 1889, Charrin published his admirable researches. He was able to produce readily and constantly by injecting the bacillus pyocyaneus into rabbits a condition characterized by a fairly constant symptom complex. Albuminuria, a low grade of fever, diarrhœa, loss of weight, and a spastic paralysis of the hind quarters formed the essential symptom train of Charrin's

" maladie pyocyanique." Autopsy examination showed vasomotor disturbances in the various mucous membranes as well as viscera.

In 1891, Schaefer published in Berlin the results of his experimentation with the bacillus pyocyaneus injected in the dog. His results were quite similar to those published two years before by Charrin.

About this time, Cadeac, working independently of the two observers previously mentioned, published a report of a case of general pyocyaneus infection in a dog. In his case, the point of entrance of the bacillus could not be determined. The animal had died with symptoms of paralysis, diarrhœa, low grade of fever, and profound cachexia. The bacillus pyocyaneus was found in the blood, lungs, spleen, and intestinal tract, post-mortem.

Although the pathogenesis of the bacillus pyocyaneus in lower animals was no longer in doubt, its ability to excite definite morbid phenomena in man was still a matter of dispute.

To Gruber belongs the credit of having first proven conclusively the ability of the bacillus pyocyaneus to produce definite lesions in man. He isolated the organism from a case of middle-ear disease, and reported his findings with such thoroughness as to remove all doubt as to the pathogenesis of this organism towards the human species. Martha about this time also reported two cases of purulent otitis media from which pure cultures of this bacillus were obtained. It has since been found in many parts of the body. The bacillus pyocyaneus is a pyogenic organism. Its most conspicuous rôle is the production of blue pus. However, like the other pyogenic organisms, it can develop in different parts of the body and produce very diverse symptoms.

Its presence in suppurating wounds is not so common as is ordinarily supposed. Jakowski found it only twice in 200 cases. In 800 autopsies held at Johns Hopkins, the bacillus was found in eleven cases. Lartigau found it three times in 100 autopsies.

It has been found in the sweat, in the saliva and sputum,

in fistulous tracts in both large and small intestines, in tuberculous cavities, in the blood in puerperal fever, in the pus of otitis media, in chronic mastitis, in tonsillitis, in diphtheritic inflammation of the œsophagus, in the saliva in noma, in meningeal exudate, in localized infection of the umbilical cord, in the pericardial exudate during life, in a case of tuberculous pericarditis, in ovarian abscess, in bronchial pneumonia, in ureteritis, in pyelonephritis, in intestinal ulceration, in hepatic abscess, in various skin lesions, principally of the ecthymatous type, in furuncle, in panophthalmitis, in ozæna, in acute angina, in bronchiectasis, in gangrene of the lungs, in ulcerative gastritis, in cholera nostras, in infant diarrhœa, in dysentery, in appendicitis, in pericarditis, in peritonitis, in bursitis, in arthritis, in acute endocarditis, in cystitis, in mastitis, in endocervitis, in orchitis, in gangrene of the nose, and in the stomach.

The studies made by Lartigau on an epidemic of dysentery caused by the bacillus pyocyaneus are of great interest and value.

In addition to the above widely diverse conditions caused by the bacillus pyocyaneus, the organism has been shown to produce general septicæmia. Ehlers early published a report of a case of general infection due to the bacillus pyocyaneus. Cases have since been reported by Oettinger, Jadkewitsch, Neumann, Schaefer, Karlinsky, Ledderhose, Krannhals, Kossel, Calmette, Williams, Lavender, Triboulet, Williams and Cameron, Pes and Gradenigo, Le Noir, Kruse and Pasquile, Lartigau, Perkins, and Barker. The authors' case hereinafter described was one of general pyocyaneus infection.

A large number of the cases reported occurred in young children and were characterized by fever varying in degree, profound intoxication, some diarrhœa, and varying nervous phenomena. Most of the cases exhibited small petechial eruptions, from which in a number of the cases the bacillus was isolated during life. In several of the cases, notably Le Noir's and Jadkewitsch's, the bacillus was isolated from the urine during life. However, in the majority of cases, the diagnosis

was made post-mortem. Jadkewitsch's case was particularly interesting. It had many features in common with the authors' case.

JADKEWITSCH'S CASE.—When the case first came under observation, a chronic eczema was noted on both legs. It was very painful, the patient seeking treatment for the relief of this pain. He had had this eczema for ten years. At times it had given him but little trouble, but he had had severe ulcerations in an eczematous patch on his lower right limb several times. At the time the patient presented himself he had but recently recovered from a severe ulceration of his right leg of nearly three months' duration. This ulceration differed from that in previous attacks he had suffered in that the pus was blue, staining the dressing deeply in a very short time. From the report of the case it was evidently a case of typical blue suppuration. The pus gradually disappeared under local treatment, and when first seen by Jadkewitsch was entirely gone, the patient presenting himself for treatment of the chronic painful eczema and for a nervous condition. He had developed paresis with anæsthesia of the whole right arm. This disappeared in seven weeks under appropriate electrical treatment. One month later blue suppuration again appeared, lasting three weeks. It was accompanied by great weakness and emaciation, dyspnœa, a slightly subnormal temperature, and a very rapid pulse ranging from 130 to 145. This lasted for four months, when recovery took place.

Nearly two years later blue suppuration again appeared in the leg. It persisted for four months, with slight intermissions lasting from two to four days. This attack was characterized by diarrhœa, slight elevation in temperature, never exceeding 38.1° C; pulse-rate from 120 to 135, profound prostration, paresis of both legs, and localized disturbance of sensibility. The lips and tongue were anæsthetic. The bacillus pyocyaneus was isolated from the urine by Jadkewitsch. No statement is made in his report whether the organism was recovered from the blood. The patient recovered from this attack, and no subsequent report has been made of the case.

AUTHORS' CASE.—Patient, Miss B., aged seventeen years, American, admitted to hospital December 13, 1903.

Family History.—Father, mother, four brothers, and one sister are living. There is no history of tuberculosis, syphilis, or nervous disease in the family. Patient herself has had the usual diseases of childhood. When nine years old she had measles, with abscess formation in the right ear. She has also had whooping-cough; has had two attacks of pneumonia,—one in the spring of 1902, lasting four weeks, the other in the spring of 1903, when the patient was in bed six weeks; has had slight rheumatism since she was six years old, the attacks usually following exposure, and characterized by sharp pains in the lower limbs and joints.

The patient, a school-girl, has led the usual life of a pupil in a country school. Her habits have been good, and, excepting the diseases of childhood previously mentioned, has, prior to the present illness, been in good health.

On November 18, 1901, in a runaway accident, she was thrown upon a hard macadamized road. She fell on her left side and lay unconscious for fifteen minutes. Upon regaining consciousness she complained of a sharp stinging pain in her left arm, but motion in the arm and fingers, although painful, was possible. Her fingers were numb. She walked to her home, a distance of half a mile. The accident happened on the 18th of the month, but a physician was not summoned until the 21st. At that time her left arm was swollen from fingers to shoulder. There was no discolorization. Movement at the shoulder-joint was normal and painless, but there was great pain when active or passive motion was attempted in the elbow-joint. Muscular power in the hand was decreased. The attending physician applied pressure bandages, but the swelling did not subside. The patient remained in this condition until April, 1903, when she sought treatment elsewhere. The arm was no longer painful, but there was no sensation in the fingers. The arm was now blistered on its outer posterior surface, in all covering an area about two and one-half inches wide by four inches long. No improvement resulted, and soon she became, as the rather unsatisfactory history has it, "completely paralyzed on the left side." She could not move her left arm or leg and had difficulty in swallowing.

She was then taken to Chicago, and was presented in the dispensary clinic of Northwestern University Medical College by Dr. D'Orsey Hecht. After careful examination, the diagnosis of "traumatic hysteria" was returned. She steadily improved under treatment, but returned home in three weeks. On June 19 an operation was performed by her local physician "to relieve pressure on the musculospiral nerve." An incision two inches long was made. The wound healed perfectly. Symptomatically, the operation was not a success, and she was therefore reoperated on July 28.

She soon regained sensation in her hand. The wound healed slowly, and at the end of the fourth week, excepting an area about the size of the end of the little finger, was covered with epithelium. The arm was entirely free from pain and there was no swelling. The wound was dressed with a 10 per cent. iodo-

form gauze dressing. At the end of the fifth week after operation, three small blisters, each about the size of a millet-seed, developed in the small area of granulating tissue still uncovered with epithelium. These rapidly increased in size, and in twenty-four hours became confluent, covering the entire granulating area. In a few hours, the one large blister broke, discharging a thin, clear, watery substance. The process was extremely painful and abrupt in onset.

Mode of Onset.—She was seized with a slight rigor accompanied by great pain in the region of the wound. The pain was at first of a boring character. It soon changed to a dull burning, and was so severe that two repeated hypodermatic injections of morphine sulphate, grains one-quarter each, were given. She complained of heat and soreness in the skin surrounding the area visibly involved. There was no itching or cracking of the skin. By the fifth day, a round area a little larger than a twenty-five-cent piece was involved. It was "one big blister," which broke and refilled every four or five hours. The discharge now assumed a grayish tinge. She was at this time in great pain, but not delirious or prostrated.

On the sixteenth day the wound took on a blue tint. In a few hours the entire surface was of light blue color. Blisters no longer formed, but the surface exuded a thin, watery fluid. This was tinged blue, and the dressings when removed were quite deeply stained. The wound was curetted and carbolic acid (5 per cent. solution) applied locally. The dressing was changed once every hour. However, in spite of all treatment, the condition gradually spread, until in seven weeks an area as large as the palm of the hand was involved. At times it was light blue, then darker blue, portions becoming dirty brown. All shades from light blue to the dirty brown could be seen in the wound at once. The discharge remained watery and thin and of blue color.

About two weeks after the appearance of the blue discharge she began to feel "a general uneasiness." She started violently and jumped at the slightest sound. The opening of a door caused her to shake with fear. This was followed by a feeling of dizziness. She had severe headache that lasted for hours, and complained continuously of severe pain in the back of her head. She answered questions intelligently, but was unable to remember. Her face, arm, and leg muscles twitched involuntarily. In all, she was profoundly prostrated.

The wound on the arm resisted all efforts to heal it. It was curetted and strong antiseptics applied, but the blue film would return in a few days, even under frequently changed and strong moist bichloride dressings. The X-ray was used for two weeks, a low vacuum-tube being applied four inches from the wound every other day for ten minutes. The wound was cauterized with the Paquelin cautery, the diseased tissue burned out; the cauterization being carried well beyond the seeming margin of the ulcer and deeply below the base. However, nothing had been of marked benefit, the process being entirely unaffected by the X-ray treatment, and recurring quite promptly after the cauterization. The wound was again curetted and pure carbolic acid applied, this also without benefit, the condition returning inside of a week as seriously as ever. The pain in the arm was so great that morphine was given frequently. The chronicity of the condition was distressing to the patient and her family, largely because of the extreme and steady pain, and it was for the relief of this that she determined to have the arm amputated, coming to the hospital for this purpose.

Status at the time case first came under the writers' observation. Patient very weak; unable to walk without being supported. Mother stated her normal weight to be 135 pounds. She then weighed ninety-two pounds. She walked with an unsteady, reeling gait, but stated that she was not dizzy. She tired on the least exertion. She had no cough. Her appetite was fitful; at times she desired food, but eating generally nauseated, and frequently caused vomiting. She had been markedly constipated, sometimes having had only one scanty bowel movement a week.

Urination had been difficult at times, and some time previously she had been catheterized for a whole week. Urination was never painful; she was simply physically unable to evacuate the bladder.

Menstrual History.—Began at fifteenth year, normal in every way until November 3, 1903, when menses ceased. This phenomenon has not appeared since.

Body in General.—Slender frame, height five feet one inch, symmetrical, no anomalies of development, musculature good but flabby, panniculus adiposus poor, large and heavy bones.

General State.—Markedly depressed; she answered questions in a disconnected manner, and was not interested in her surroundings. She seemed almost in stupor, it being difficult

to arouse her. Occasionally she uttered a low moan. She had not been delirious. She lay in the same position for half an hour at a time, not attempting to arrange herself comfortably, even though the position assumed be an uncomfortable one. She had slept but little for several weeks, the extreme pain in the arm and head making it impossible. She complained of a dull ache in the back of her head. Temperature and respiration normal; pulse, 101.

Skin.—On the face, body, and lower limbs clear and of good color, but cold and moist. There were no scars or eruptions. Skin of left arm on its entire outer surface was bronzed, due to the use of the X-rays in treating the local ulcer. On the outer anterior surface of the left arm, occupying an area about the size and shape of the palm of the hand, was a large ulcer, its margins sharply defined and indurated, and the whole slightly elevated. The base of the ulcer was blue, the shade of blue varying in different parts of the ulcer; in some portions being light sky-blue, in others darker blue, while some areas were brown. The light blue areas were bathed with a thin watery fluid which stained the dressing blue. The fresh stains of the dressing were of a light shade of blue, but after half an hour's exposure to air the color changed to a darker blue (about the shade of Loeffler's methylene-blue solution). The brown areas were dried, hard, and firm. There was little or no exudation from these areas. They consisted of thin, very adherent crusts, the surface bleeding quite freely if irritated.

Scrapings were made from the surface of the wound and stained in Loeffler's methylene blue. The following rough findings were made at this preliminary examination:

Light Blue Areas.—An exudation from one to three millimetres thick extended over these areas.

The exudation was moist, and was readily removed with the platinum loop, causing no bleeding.

In consistence it resembled the scraping obtained from a caseated bronchial gland.

Dilution drops were made and cover-glass smears were stained with Loeffler's methylene blue. They took the stain readily. In these, upon examination, were found a large number of blastomycetes. They consisted of a central cell-body about the size of a red blood-cell surrounded by a capsule of equal thick-

ness. The capsule did not take the stain readily, but in a number of cases the outside rim of the capsule stained faintly. There were a few small bacilli in these sections and masses of detritus taking a heavy deep blue stain.

Brown Areas.—In the brown areas, scrapings were obtained with difficulty. The exudate was hard and dry and very adherent, so much so that when a portion was broken off for examination the denuded area bled freely. Examination of the scrapings of this area showed a few blastomycetes, all of them in a budding state. No bacteria were seen.

The wound was extremely painful, and the small amount of manipulation necessary in obtaining the scrapings caused great discomfort. Examination of the lungs, heart, and abdomen was practically negative. The spleen could easily be palpated. It was markedly increased in size, extending a full inch below the ribs with the patient in the reclining position. No enlarged lymphatic glands could be felt, but tenderness was present in the pit of the left axilla. There was neither redness nor œdema in this axilla.

The patient was placed under close observation and vigorous saline catharsis begun. Moist dressings of bichloride of mercury, 1–5000, were applied, the dressings being changed every half-hour day and night. There was no increase in temperature, although the pulse-rate was high.

The local condition on the arm did not improve. On December 15, under a general anæsthetic, the blue slough was removed, great care being taken not to button-hole the surface taken off or infect the fresh tissue with the area being removed. A fresh, clean surface was thus obtained. Moist bichloride-of-mercury dressings, 1–2000, were applied, and the dressing changed once an hour. The patient's mental condition improved at once. She became more cheerful; she no longer experienced the violent pains in her arm and head, answering questions readily. The wound on the arm was soon covered with healthy granulations. The base of the wound was largely composed of tissue of the cut arm muscles. These muscles could be seen occasionally to jerk and twitch. This was not painful.

On January 4 the patient sat up. She had been free from pain in the arm since the operation, made three weeks previously, and the granulating area on the arm was free from blue pus. The

wound was covered with an ordinary dry dressing and bandage. She attired herself in the dress which she had worn when she entered the hospital, and in a very few hours was seized with a violent chill. The abruptness of the onset was marked. A distinct chill lasting for about half an hour was followed by profuse sweating. Her arm at once became very painful. The bichloride dressings had been continued without interruption from the time of operation. Examination at this time was negative. Three hours later the arm was re-examined, and three small blue spots the size of pin-heads were seen. These were in the centre of the granulating area, and none were nearer than half an inch to the margin of the wound. These areas were carefully cut out and the spots cauterized with pure carbolic acid. However, the girl became more and more depressed.

Bichloride-of-mercury dressings, 1–3000, were now applied and changed every twenty minutes. The process spread rapidly in spite of this, and in ten hours the entire area of granulation was covered with a light blue membranous exudate, staining the dressings bright blue a few minutes after they were applied. The patient refused food, complaining continuously of the pain. The temperature remained normal or slightly subnormal. The pulse was rapid, ranging from 90 to 120, and of a light thready character. Stupor was very pronounced, at times it being almost impossible to arouse her. She did not become emaciated.

Cultures were made from the surface wound, January 7. The plates were developed at ordinary room temperature, which was hardly more than 65° F. The growth on the plates was slow.

1. On the third day, small grayish pin-point colonies appeared. Under low magnification these colonies were seen to be roundish in shape, with faintly defined borders. In the centre was a dark mass. The periphery shaded off into the medium, the whole being granular. There was no liquefaction. Agar-agar, glycerin-agar, and gelatin cultures were made. When the cultures and plates were taken into a warm room, the growth was very rapid. In twenty-four hours the colonies attained a diameter of from one-quarter to three-quarters of an inch, and liquefaction progressed rapidly, the centre becoming liquefied first.

2. On the eighth day, colonies of another variety appeared. They were round, elevated, and about half the size of a small millet-seed. They did not liquefy. Stab gelatin cultures and agar-agar and glycerin-agar cultures were made.

Cultures.—Colony 1. The growth from colony 1 proved to be that of the bacillus pyocyaneus. The growth was characteristic, liquefying gelatin rapidly and developing in funnel form. Green coloring matter (pyocyanine), soluble in chloroform, developed after the fourth day. After seventeen days all the gelatin was liquefied, and the culture was simply a mass of light greenish-colored fluid. This gradually darkened and became brown. On agar-agar and glycerin-agar a gray surface growth developed along the line of scrapings with the platinum loop. The growth was distinctly grayish and remained of this tint. At the eighth day the medium began to be tinted a faint green. The coloring extended far out into the medium from the surface of the growth. After two weeks, the entire mass of the medium was tinted a bright green. The growth, however, remained grayish.

Morphology.—With hanging drop and oil immersion the organism could be seen to be rapidly motile. It stained with ordinary aniline dyes and was a short bacillus with rounded ends.

Colony 2. The organism grew slowly in gelatin, no colonies appearing until the ninth day. The growth was along the entire line of the stab puncture and was greatest at the surface. It tended to spread over the surface of the gelatin. There was no liquefaction.

Cultural Characteristics.—Stab cultures in gelatin developed a growth along the entire line of puncture at ordinary room temperature. There were no gas bubbles, nor did liquefaction occur at any time. The organism developed slowly. Involution forms appeared. On the sixth day after the first appearance of the growth, two series of transplantations were started, one in which a new culture was made every four days and one in which a new culture was made every three days. The growth transplanted every four days lasted twelve generations, when it ceased to develop. The growth transplanted every three days lasted nineteen generations, when it ceased to develop. At the third generation in each series, the individual cell lost its capsule and became irregular in shape, varying from a round body, about half the size of a red blood-cell taking a deep stain, to an irregular oval body, the long diameter of which was about the size of a white blood-cell. The cells grew smaller and smaller, and in the ninth generation looked like a zooglia mass of irregularly shaped cocci, taking, however, a deep nuclear stain. Individual cells,

when seen separate and apart from a mass collection, did not show a capsule. On agar-agar (neutral reaction) and agar-agar litmus (alkaline) no growth developed. On glycerin-agar growth developed on the twelfth day and died out in three generations.

An attempt was made to grow the organism on wort gelatin; the results, however, being less encouraging than with plain nutrient gelatin, the organism dying in the fourth generation. The organism apparently developed as readily under practically anaërobic as aërobic conditions. A tube of gelatin was taken and inoculated as in an ordinary stab culture, and the contents of another tube of gelatin melted at a low temperature and poured in over the surface of the tube previously inoculated. A growth appeared in the deep portion one and one-half inches from the surface of the gelatin in nine days.

Morphology.—The organism stained readily with the ordinary aniline dyes, and was found to be about the size and shape of a red blood-cell, taking a very deep stain. Each cell was surrounded by a capsule of about the same thickness as the deeply stained portion of the cell. The capsule did not take the stain except at its outer margin, which stained faintly. The capsule was best demonstrated by the following technique:

1. Specimen stained in carbol fuchsin for five minutes, raising the stain to the boiling-point.

2. Washed thoroughly in water.

3. Decolorized for two minutes in one-half per cent. solution of hydrochloric acid in 80 per cent. alcohol.

By this technique the cell-body was stained deep red, but not so deeply as to mask the cell structure. Care was taken, however, in decolorizing not to completely remove the stain from the cell. By carefully decolorizing, the cell-body was seen to be highly granular with light unstained areas. No reticulum could be made out. The capsule stained a delicate pink, the outer margin of the capsule taking a distinctly darker tint. The stain was not permanent, the pink in the capsule disappearing in a few weeks. However, the rim of the capsule and the deep staining cell-body remain stained after two months.

The ordinary budding forms of blastomycetes were found after the third day in the culture.

On January 10, petri-dish plates were made from the blood.

Technique.—A. The ball of the thumb of the right hand (the ulcer was on the left arm) was carefully scrubbed with green soap and a stiff brush for fifteen minutes.

B. Washed with sterile water for ten minutes.

C. Washed in 95 per cent. grain alcohol for ten minutes.

D. Soaked in solution of bichloride of mercury, 1–1000, for ten minutes.

E. Washed in normal salt for fifteen minutes.

F. Washed in sterile water for fifteen minutes.

Surface of the thumb was scraped carefully with platinum loop and four petri-dish control plates were made. The thumb was then lanced and a free hæmorrhage obtained. The first few drops were removed with filter paper previously sterilized. Five petri-dish preparations were then made as follows:

Plate 1. Five drops of blood in a tube of three inches of gelatin.

Plate 2. Seven drops of blood in a tube of gelatin three inches deep.

Plate 3. Nine drops of blood in a tube of gelatin three inches deep.

Plate 4. Eleven drops of blood in a tube of gelatin three inches deep.

Plate 5. Twelve drops of blood in a tube of gelatin three inches deep.

Findings.—No growth of any kind developed on the plates made from the skin. Plates 2, 4, and 5 developed colonies which were alike in all cases. They were small and round,—grayish in color,—and grew rapidly at ordinary room temperature. After thirty-six hours they began to liquefy at the edge, and in four days the medium immediately around each colony was tinted a light bright green. Cultures were made from the colonies. They grew quite readily on agar-agar, glycerin-agar, and nutrient gelatin.

Growth in Gelatin.—This growth was rapid in its development, growing in the characteristic funnel fashion. Liquefaction began on the third day. On the fourth day a green tinge could be observed spreading out into the medium from the growth. In a week, the entire mass of unliquefied gelatin was tinged a bright green. Soon the entire mass of gelatin was liquefied and the entire liquid mass was green, but gradually grew darker and

darker, finally becoming brown in color. Before the mass became entirely liquefied, the green color was confined to the unliquefied medium, the flocculent growth being grayish and absolutely devoid of green.

On glycerin-agar and agar-agar the growth developed rapidly along the line of smear. In seven days the medium immediately beneath the growth was tinted green, the green spreading into the medium with great rapidity. In a week the entire medium was tinted green, but the growth was grayish, and remained so throughout, never acquiring the green tint so plainly seen in the medium. The organism was developed at ordinary room temperature.*

Morphology.—The organism proved to be a small bacillus with rounded ends about two and one-half to three times as long as wide.

Hanging-drop preparations showed a motile organism. Motion was lost after two days' growth in gelatin. Staining for spores gave a negative result. The organism, from its cultural and morphological characteristics, was identified as the bacillus pyocyaneus. Cultures were made following the technique de-

* We are aware that the technique used above is not the most approved one for making a bacteriological examination of the blood. We did not have on hand at that time the large quantity of bouillon necessary, so we did not draw off blood in a syringe and inoculate a large quantity of bouillon with a small quantity of blood, as is the usual method. However, the usual method, it seems to us, is preferable to the method used, only in that it is more liable to yield positive findings. By the use of the large quantity of gelatin, we in a way diluted the blood, and thus reduced to a certain extent the possible bactericidal action of the blood, which after all is one of the chief virtues of the methods in which large quantities of bouillon are used. Positive findings are of value, no matter what the technique, providing, of course, they are not subject to objection on the ground of inaccuracy. Great care was taken in every step in preparing the thumb to remove the possibility of contamination with organisms upon the skin, and we feel that the thumb was as aseptic as it is possible to render the living tissue. The non-development of the five control cultures made from the skin at the point of withdrawal adding evidence to our belief that there were no germs on the skin. The bichloride was mechanically, instead of chemically, removed by the normal salt and water, much time being taken and a large volume of fluid being used, so that we feel that the failure to obtain any growth from the skin scraping was not due, as is often the case, to a small amount of the bichloride being carried into the medium.

scribed above on January 14, 17, 20, 24, and 26. The drops were taken from different portions of the body each time and control cultures made in every case. In every instance the control culture failed to develop. On the 14th, 17th, and 20th, a pure culture of the bacillus pyocyaneus was obtained, but on the 24th and 26th we were unable to grow cultures. On the 26th only one petri-dish showed any development, it being the one in which there were twelve drops of blood, only one colony developing. In the preparation taken on the 24th and 26th there were no developments.

Urine Examination.—The urine was examined frequently, the following being a report of the first examination made.

Reaction, acid.

Specific gravity, 1027.

A. Soluble constituents.

1. Albumen test.
 a. Nitric acid and heat, positive.
 b. Acetic acid and ferrocyanide, positive.
2. Sugar.
 a. Fehling's and Boettgar's tests, both negative.
3. Bile.
 a. Iodine and Jolles' tests, both negative.
4. Diazo reaction, absent.
5. Acetone, absent.
6. Urea, quantitative estimation, normal.

B. Sediment, small in amount; composed largely of calcium oxalate crystals.

Examination was made daily. A varying amount of albumen was present; otherwise, the examinations were negative.

Blood Examination.—Marked leucocytosis was present, mostly of the polymorphonuclear variety. A few eosinophiles were seen. There was poikilocytosis.

These findings were of unusual interest in view of the symptom complex observed. The patient was evidently suffering from an acute intoxication of severe grade. She had no elevation of temperature; in fact, her temperature may be said to have been uniformly subnormal. Her respiration had been high, varying from 25 to 35, and her pulse small and running between 90 and 130. The most marked symptom was the marked degree of mental hebetude. There had been profound stupor for many weeks, at times approaching coma. Although the element of

hysteria was to some degree in evidence in the patient, it could hardly account for the profound depression and lack of ordinary intelligence. She was not marasmic. Removal of the only discoverable inflammatory focus, the ulcer on the arm, while it gave relief from the pain, did not completely relieve the pronounced symptoms of the toxæmia, the patient being restless and prostrated as before.

Treatment.—It is an interesting fact that the use of serum from immunized animals as a therapeutic measure has been proven to be of value in infections with the bacillus pyocyaneus; in fact, Bouchard prepared and used successfully an antipyocyanic serum four years before Behring gave to the world diphtheritic antitoxin. Bouchard's method of preparing the serum was very simple. A healthy rabbit was selected and inoculated with a sterile beef-tea culture of the bacillus pyocyaneus. This produced a slight reaction. The rabbit was then successively inoculated with increasingly stronger cultures of the living organism in the usual manner until an immunity was produced protecting it against an inoculation which otherwise would have been rapidly fatal to an unimmunized animal. Blood was then withdrawn and the serum secured in the usual manner. This serum was not only protective, but curative. It took about seven months to develop in an animal an immunity yielding a serum of value.

This serum, however, is not an article of commerce, and could not be found on the market, nor could any be obtained from any of the large biological laboratories. The case was therefore treated symptomatically.

A study of the reported cases of local infection by blastomycetes shows that the treatment giving most favorable results consists in the use of large doses of potassium iodide.

The patient was given fifteen drops of potassium iodide well diluted every three hours. Under ether anæsthesia the sloughing mass on the arm was excised. Ichthyol (10 per cent. in glycerin) was applied locally to the wound, the dressing being moistened with fresh solution every hour and changed every four hours. The application was non-irritating and, excepting the offensive odor, was agreeable to the patient.

On the third day after the operation she again complained of pain in the arm. The pain was not so great as it had been, yet was such as to cause fear on the patient's part lest a recurrence develop. Examination revealed nothing; the ichthyol discoloring the surface and masking it. On the sixth day, examination showed the margin of the wound to be hard and indurated. The patient complained continually of pain in the part, and, although examination revealed but little, the surface being masked by the ichthyol, there could be no question but that a recurrence had appeared.

The girl became decidedly more nervous and irritable. She jerked and twitched, and of necessity was watched to prevent her escape from bed. The pain in the arm became so intense that morphine sulphate, grains one-eighth, were given hypodermatically every three hours. This did not suffice to entirely relieve the pain. The pulse was high and rapid, ranging from 94 to 115. Her temperature ranged from 96.7° to 98.2° F. Only once did it reach 99°. Both temperature and pulse were lowest in the morning and reached their greatest height in the afternoon.

On January 20 it was necessary to discontinue the potassium iodide, as it could no longer be retained. An elixir of salicylic acid ten grains to the drachm was substituted, one drachm being given every four hours. This was well borne by the stomach. In three days, tincture of chloride of iron, drops fifteen three times a day, was added. However, the pain in the arm steadily increased, so that in twelve hours seven-eighths of a grain of morphine had been given her without relief from the pain. It was now decided to return to the potassium iodide, and ten drops were given every two hours. In three days the pain left the arm, and, although restless, nervous, and irritable, the girl did not seem to be in pain. The tincture of chloride of iron and the saturated solution of potassium iodide with local application of the 10 per cent. ichthyol were continued until the patient left our observation. The wound in the arm began to heal. When she left the institution, the wound was circular, with a diameter of about one-half inch. The margins were soft and the base on a level with the surrounding skin. She was sent to her local physician, with the recommendation that the treatment (frequently repeated large doses of potassium iodide and tincture of chloride of iron together with a local application of 10 per cent. ichthyol in glycerin) be continued. In a recent letter he states that the

wound is completely covered over with healthy normal epithelium, excepting an area as large as the nail of the little finger. He has reduced the dosage. The patient herself is leading an active out-door life and is apparently well.

While the patient was in the hospital her mother called. She stated that she had been "troubled with boils." Six weeks previously she had noticed a small, hard lump develop on the back of her left hand. It was about the size of a pea when she first noticed it. It gradually grew larger, until it reached the size of a small pigeon egg, when it gradually disappeared. At no time was it painful, nor was the overlying skin reddened or tender. It did not soften and break as she had expected it to do, but remained hard, gradually becoming smaller until it entirely disappeared. She did not open it nor break the skin. A few days after this had entirely disappeared, she noticed on the point of her elbow a hard, round body about the size and shape of a marble with a diameter of about half an inch. She herself states that it felt exactly like the growth which had appeared upon her hand. It was not painful or tender and had been there for some time, she thought, before she discovered it. It increased in size slowly, and on the advice of a friend she opened it with a needle. A thin, grayish, watery substance was discharged. Examination of the discharge showed it to contain blastomycetes in the budding form in great numbers. The budding was very marked; in fact, there were very few cells seen which did not show some budding. Examination of the axilla revealed a large, hard mass about the size of a hen's egg. The patient did not know it was there, as it was not painful and did not cause the slightest inconvenience. She was put upon potassium iodide and sent home.

The discharge in the elbow subsided shortly, but the large mass in the axilla broke, and discharged, according to the patient's statement, nearly two cupfuls of a thin, watery, grayish substance. No examination was made of the substance discharged. The patient has continued the use of potassium iodide, but she still has a discharge in the axilla. The patient stated at the time of examination that her son, a nineteen-year-old boy, had a similar discharge from his hip. A small kernel had developed to the size of a large hen's egg, had broken and discharged a thin, watery content similar to that seen in the mother. It had broken some three months before, but was still discharging. This is of peculiar interest in that we have three cases of blastomycetic

infection in the same family. In the mother and brother there was no apparent involvement of the skin and no pain, although in the sister this was quite marked.

Conclusions.—The interesting features of this case suggest the following conclusions:

First. There existed a general septicæmia caused by the bacillus pyocyaneus. The clinical manifestations were not such as would lead to the complete diagnosis, this resting entirely upon the bacteriological findings. There was every evidence of profound intoxication. It was accompanied by a very high pulse-rate with a temperature usually subnormal. Most of the cases heretofore reported have shown some elevation of temperature, with pulse-rate not so high as in the authors' case.

Second. Probably the most marked feature, and certainly one of diagnostic value, was the marked nervous involvement. It has been demonstrated that pyocyanine injected into guinea-pigs produces marked and violent convulsions. Large doses were fatal, while smaller doses produced an increased nervous irritability. In many respects the case is similar to Jadkewitsch's.

Third. The finding of blastomycetes in the local ulcer at once cleared our diagnosis, and explained the failure of the wound to heal. The combination of the blue pus bacillus infection with the blastomycetic infection was unusual. We have been unable to find any report of another similar instance in literature.

Fourth. We had in this case a clean incised wound healing by first intention. The wound became infected with blastomycetes primarily, with the bacillus pyocyaneus secondarily. Many cases of wound infection have been observed due to the bacillus pyocyaneus; but the ability of blastomycetes to infect clean wounds and produce delay of union, with destruction of tissue, is not generally recognized. While the complication is rare, owing to the limited distribution of pathogenic yeasts, still it should, we feel, be given more consideration than is now accorded it.

THE BRIDGING OF NERVE DEFECTS.[1]

A CONTRIBUTION TO THE SURGERY OF NERVES.

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It is difficult to make a satisfactory review of this subject. The operation itself deals with those cases in which approximation of the divided nerve segments—simple nerve suture—is impossible; but we know that ordinary neurorrhaphy, primary or secondary, is not invariably successful, for it happens only too often that under favorable conditions of approximation the functional result is far from perfect. In the present state of our knowledge it is not easy to give the percentage of failure in suture with good approximation, so that in attempts at bridging incoercible separation of the divided ends of a nerve we are uncertain as to how much of the success or failure depends upon factors which are not under the control of the operation itself. In other words, given a case in which some form of attempt at bridging has failed, it is impossible to say that a good functional result would have been secured had perfect approximation been obtained.

Other difficulties are referable to the manner in which the subject of nerve suture is treated in medical literature. The Index Medicus has no classification of it, and the writer[2] has endeavored to consult all of the sections which might bear indirectly thereon. Most of the studies on nerve surgery are hidden away in such sections as Operative Surgery, Surgery of the Extremities, Surgery of the Head and Face, etc. Such a condition has a twofold significance, for, while it argues some

[1] Read before the American Surgical Association, June, 1904.

[2] The author acknowledges his indebtedness to Dr. Edward Preble, of New York, for valuable aid.

defect in the method of indexing, it implies at the same time that the subject itself is not one of great importance or interest.

It might be thought that the enormous amount of material in the domain of surgery of the nervous system collected and published by Chipault should contain everything of interest upon the subject of nerve suture. But the " État actuel de la chirurgie nerveuse" contains no analytical index, and of the large number of references cited in the work which bear upon this subject very many—especially the inaugural dissertations of foreign universities—are inaccessible to the American reader.

Further, it should be emphasized that much of the material comprised in the literature of the subject consists of operations upon animals. Quite a number of authors whose names are mentioned in connection with the work—Vanlair, Assaky, and others—never reported cases in human surgery. Létiévant, who is much quoted for his pioneer work in this field, operated but twice on the human subject, and the result in each case was complete failure.

Finally, a large proportion of the operative cases are reported at a period before the establishment of a permanent result, and at a time when early return of sensation may be explained by collateral nerve supply, and early return of motion may be considered due to vicarious movements of other muscles than those formerly paralyzed. (Peterson.)

The subjects of nerve repair and regeneration, of simple neurorrhaphy,—primary and secondary,—and of the more simple and obvious means of approximation of the divided ends of nerves, such as stretching and posture, are fully discussed in a somewhat abundant literature, as are likewise such allied procedures as neurolysis, the implantation of a healthy nerve into the nerve of a paralyzed muscle, and the after-treatment of nerve suture, however performed, by electricity and massage.

On the other hand, the more unusual resources for restoring the continuity and functions of severed nerves have a relatively small literature, at least so far as attempts at con-

sidering the entire field in a single paper are concerned. Individual case reports abound, and in some of these attempts are made to consider the subject of bridging defects at some length, but actual monographic studies are but little in evidence.

In Chipault's " Chirurgie opératoire du systeme nerveux," 1895, we find a systematic account of this subject, but without a complete list of cases. In the same year Huber made a meritorious attempt to collect all of the recorded cases in which nerve defects were bridged (*Journal of Morphology*). His combined material amounted to some twenty-two cases, over half of which were examples of the grafting of foreign substances.

In 1894, Spijarny published, in an inaccessible Russian journal, a list of nearly 200 cases of nerve suture of all kinds found in literature, and of these thirty concerned the bridging of defects. There were eleven operations of flap-splitting, eleven of foreign grafts, one of implantation, one of *suture à distance,* four of tubulization, and one of resection of bone. This series is of no special value, for some cases are said to be recorded twice, while the tubulizations are in part cases of simple suture with the superaddition of tubulization.

There are also several inaugural dissertations which treat of bridging defects, but the writer has been able to consult only Ehrmann's " Contribution a l'étude de la suture de nerfs à distance," Paris, 1896. This author, while discussing all of the operations for bridging defects, confines his actual material to *suture à distance.*

There are a few monographic studies devoted to particular operations. Thus, Peterson (*American Journal of the Medical Sciences,* 1899) has certainly done all that was possible with the subject of grafting proper, relating twenty histories in all, several of which appear for the first time. Dumstrey, " Ueber Nervenpropfung," *Deutsche Zeitsch. f. Chirurgie,* lxii (1901–2), made a rather unsatisfactory attempt to collect the published cases of nerve implantation, a number being omitted. Ehrmann's thesis on *suture à distance* has already been mentioned; it contains all of the cases (three) of this operation to

date (1896). The writer does not learn that the subjects of flap-splitting and resection of bone have ever been submitted to a critical study.

The sections on nerve surgery in Chipault's monumental "État actuel de la chirurgie nerveuse," 1901–1903, contain much material of interest on bridging defects, although this occurs in scattered fashion.

As already intimated, it is doubtful if a complete series of cases of the bridging of nerve defects can be compiled. The plan pursued by Chipault in securing a surgeon from every country in the world to collect the material of his own land has made the list of inaccessible publications much larger than would otherwise be the case. Moreover, a study of the entire material of neuroma would probably lead to the discovery of cases of implantation, etc., which have escaped the compiler. Thus, Maydl and Kukula, who covered the material of Bohemia for Chipault's work, speak of two cases of nerven-plastik as having been done in that country, although details fail.

Excluding all doubtful cases, the material found is as follows: Grafting, 22; flap operations, 11; implantation,* 10; resection of bone, 7; *suture à distance,* 5; tubulization, 1. Total, 56.

Grafting.—In this section the writer will use Peterson's admirable analysis, after first inserting two cases not included therein, one being his own. These are as follows:

Durante (*R. Accad. Med. di Roma,* April 24, 1892), in removing a tumor (osteosarcoma) of the head of the fibula, was obliged to resect a portion of the external popliteal nerve. As it was found to be impossible to approximate the severed ends, he inserted a graft of five centimetres of a dog's sciatic, suturing it in place with catgut. After operation movements of toes and foot notably improved, particularly those of dorsal extension and abduction, sensation also improved. (Report made at the end of a month.) However, rapid recurrence of

* Only those cases are taken in which the operation was undertaken to correct a defect. Cases of implantation for the relief of facial and Duchenne paralysis are not included.

the malignant growth made it necessary to amputate the leg. Dissection showed that the graft had entirely disappeared. An accurately recorded result is not given. We simply gain the impression that the result was good at an early day after operation. This is a fair illustration of the difficulty which the writer has experienced in judging of the results in the cases found in literature. Generalities abound, but accurately recorded *late* results are scanty.

The Author's Case. Nerve Transplantation. Implantation of Four Inches of the Great Sciatic Nerve of a Dog in the External Popliteal of a Man. Result at End of Eight Years.

C. O., a young man of eighteen years, came under my care at the Denver City Hospital, May 10, 1896, with a history of having been run over by a railway train twelve hours before. On examination he was found to have a crush of the right great toe, deep lacerated wounds of the right gluteal region, and a fairly extensive lacerated wound at the outer aspect of the right knee with a compound, comminuted fracture of the head and neck of the right fibula. There was complete anæsthesia and paralysis of the parts supplied by the external popliteal nerve. Dirt and coal-dust were ground into all of the wounds. Under ether the toe was amputated, the gluteal wounds cleaned and sutured, comminuted fragments of the fibula removed, and the lacerated wound at this point trimmed, cleaned, and partly sutured. The popliteal nerve was not found in its usual place below the head of the fibula. An attempt was made to locate its ends, but they were not easily found, and prolonged search was not made. It was thought wise to first gain healing of the wound and then make secondary suture of the nerve. The wound healed in part by primary union, in part by granulation. June 27 it was closed, and on that day nerve transplantation was done as follows:

Ether. Esmarch's bandage. Seven-inch incision at outer aspect of knee. Scar tissue removed. The lower end of the upper fragment of the external popliteal nerve was found without difficulty. It was bulbous. Considerable time was spent in searching for the lower fragment, the peroneus longus muscle being fully exposed. An incision was made in front of the

fibula and the anterior tibial nerve was found lying on the extensor longus digitorum. This nerve was traced upward and the external popliteal discovered, its bulbous end being about one-third of an inch above the division of the nerve into the anterior tibial and musculocutaneous. Both bulbous ends were pared; about three and one-quarter inches of space intervened.

During this work, my colleague, Dr. Freeman, had kindly exposed the great sciatic nerve of a thirty-five pound dog. A fragment four inches long was removed, passed between the peroneus longus and the fibula of the patient, and implanted in the external popliteal. Three sutures of fine chromicized catgut were used at each end, one suture being passed through the nerve substance, the other two uniting the sheaths. The fragment was slack and the ends lay in perfect approximation. The external wound was sewn without drainage, the knee placed at an angle of 135°, and a large aseptic dressing with plaster-of-Paris splint applied. Primary union. The knee was confined for a month.

Just before operation, the patient was examined by Dr. J. T. Eskridge, neurologist to the hospital, who reported anæsthesia of the skin area, supplied by the external popliteal nerve together with complete paralysis of its muscles. According to notes made at the time, Dr. Eskridge examined him again on July 20, saying that the anæsthetic area remained about the same as before the operation. August 4 he says, "Temperature, pressure, pain sensations, and ability to recognize cold substances have returned over the entire anæsthetic area. Tactile and localization sensations and ability to recognize warm substances are a little impaired. All forms of sensation are delayed." Under date of August 11 he says, "All forms of sensation normal." On August 13 Dr. Eskridge reported that the tibialis anticus and peroneus longus would not respond to the strongest faradic current.

At this time the patient left for his home in Michigan. I did not hear of him again until April of the following year, at which time Dr. Reuben Peterson kindly examined him, and reported as follows under date of April 3, 1897:

"Patient can feel the touch of a pencil over the entire leg and foot, but sensation is somewhat diminished over an area three or four inches long by a couple of inches wide at the external part of the lower third of the leg, and on the internal aspect

of the instep down to the scar made by the removal of the great toe. There is considerable atrophy of the muscles of the leg in the upper third. Circumference of the right leg, eleven inches; left, twelve inches. Middle of calf, twelve inches on the left leg; eleven inches on the right leg. Upper third, right, seven and three-quarters inches; left, eight and one-quarter inches. Abduction of foot impossible. No movement of toes except those controlled by extensor tendons. First and second toes somewhat contracted. Unable to hold foot up. Has good movement in walking, except that he has to lift right leg higher than the other to keep the toes from dragging. I should say that the result is good as far as sensation is concerned, but negative as regards motion. The muscles fail to react to electricity." Another operation was at this time advised, but declined.

A further report on the case was courteously made by Dr. Richard R. Smith, of Grand Rapids, Michigan, August 31, 1903, seven years after operation. Dr. Smith writes as follows:

"There is a very decided atrophy of the anterior muscles of the leg. The patient is unable to flex the tarsus upon the leg in the slightest degree, nor is he able to extend the phalanges of the toes. There is complete paralysis of the tibialis anticus, the extensor proprius pollicis, the extensor longus digitorum, the peroneus longus and brevis. There is partial anæsthesia over the area supplied by the peroneal nerve."

The end result in this case is, then, a complete failure as regards motion, and this in the face of conditions which seemed to promise a good result. The ends of the implanted fragment were carefully approximated, the sutures suitable, wound healing was perfect, and the fragment stayed in.

Summary of Twenty-two Cases of Nerve Grafting.—

1. Case dismissed too early to record result.
2. Implanted segment came away necrotic.
3. Case dismissed too early to record result.
4. Negative at end of one year.
5. Sensation began to return in two months. Motion not recorded.
6. Suppuration. No improvement at end of two months.
7. Sensation good at end of five weeks. Motion indefinitely recorded.

8. At end of ten weeks an indefinite result is recorded.

9. At end of two years sensation "dull;" motion fair.

10. Motion and sensation (median) practically restored at end of six years.

11. Case reported too soon (sixteen days).

12. At end of three months, ulnar. Sensation hardly complete. Motion indefinite.

13. At end of eight months. Motion fair. Sensation not noted.

14. Reported too soon to be of value (thirty-six hours).

15. Sensation returned (fifteen days?), but motion did not.

16. No result at end of two and three-quarters months.

17. No result at end of three years.

18. No improvement.

19. "Good" result at end of two years. (Median.) Sensation good; hand "lame but useful."

20. One and one-half years after operation (at end of four months patient froze hand, losing distal phalanges of first and third fingers). Sensation nearly normal. Hand used daily in work; fine movement of it impossible; some atrophy of muscles.*

21. Short time—leg had to be amputated—motion as well as sensation seemed to be returning. (Durante.)

22. Author's case. Reported at end of eight years. Failure.

As Peterson's paper is readily accessible, the reader is referred to it for details. The writer has added to the twenty cases there recorded that of Durante and his own. These seem to give three "good" results (Cases 10, 19, 20) and three which may be termed "fair" (Cases 9, 13, 21). Twenty-two per cent. of the cases operated on may be said to have terminated in a satisfactory way, although in most of these the final result is not recorded with the detailed accuracy desired by one who

* A recent letter from Dr. Peterson reports this patient as being at this time "perfectly well as regards the use of his hand."

would analyze them. One is forced to say that he questions the authenticity of some of the results accounted "satisfactory."

To this must be added the claims of various surgeons and experimenters that a piece of nerve has no intrinsic superiority as a graft to any other kind of organized tissue, and that given proper isolation of the divided ends from the surrounding tissue a bridge of any sort—a bundle of catgut loops for example—is sufficient to permit of the regeneration of the nerve.

The writer, in studying this branch of the subject, concludes that nerve transplantation should be discarded.

Flap Operations.—While several forms of neuroplasty have been proposed, the principle of all is the same, viz., a portion of the central or peripheral (or both) ends is partly detached, turned back, and united to the other end or flap. The principles underlying these operations, the technique, etc., have been fully described in text-books and monographs. (De Forest Willard.)

The writer herewith briefly recapitulates the cases found by him in literature.

1. Létiévant, the deviser of the operation, experienced failure in his only case in human surgery. (See Chipault's "Operative Surgery of the Nervous System," 1895.)

2. Dittel, another early operator, reported a failure (*ibid.*).

3. Wölfler ("Neugebauer, Neurorraphie u. Neurolyse," *Beiträge z. klin. Chirurgie*, xv, 1895) did a neuroplastic operation after injury to the radial; the patient shortly disappeared from view.

4. Tillmann's case reported in Chipault's "Operative Surgery of the Nervous System," neuroplasty of median and ulnar nerves, success.

5. Gleiss—same reference—successful neuroplasty of ulnar.

6. Brenner (*Wien. klin. Wochen.*, 1891). This case is remarkable in that operation was performed ten years after original injury. A flap operation was done upon the median nerve with a good ultimate result.

7. Bobrow (1893, cited by Spijarny, original journal inaccessible). Excision of tumor involving sciatic in elderly man. Flap operation. Return of sensation and of use of flexors of knee (?).

8. Giordano (*Clinica Chirurgica*, March, 1899). This surgeon, in removing a tumor of the neck, was obliged to resect four centimetres of the vagus, the defect being overcome by a flap operation. Patient lived a year. For a short time after the operation he coughed at times.*

* This case should really be discarded, for it is known that the vagus of one side may be resected with comparative safety.

9. Von Bruns (*Allegem. Zeitsch. f. Psychiatrie*, Band lii (1895–6). This surgeon operated upon an infant aged two months for congenital neurosarcoma of upper arm involving ulnar and median. No attempt to restore continuity of nerves until a year had elapsed, when, to overcome the paralysis, a flap operation was performed on both nerves. Under appropriate after-treatment there was an excellent return of function in the domain of the ulnar and a partial return in that of the median.

10, 11. The writer has not access to the cases of Lossen (Hueter-Lossen, Grundrisse d. Chirurgie, seventh edition, 1896) and Gundt (Inaug. Dissert., Berlin, 1897). He gathers the impression that these cases were successful.

Of these eleven cases five are discarded as having been reported too early or as lacking in detail. Of the remaining six, two were failures and four complete or partial successes.

Implantation or Anastomosis.—The ten cases in which defects in the continuity of nerves were overcome in part by anastomosis are as follows:

1. Kennedy (Vol. ii of Chipault's "État actuel," etc.). In one case, Kennedy implanted the central ends of the median and ulnar into the radial. Result negative.

2. Despres (cited by Dumstrey) implanted an injured median into the ulnar and obtained a "fine result."

3. Gunn (cited by Dumstrey) sutured the distal end of the ulnar (after removing a neuroma) into the median. Sensation returned; no report as to motion.

4. Sick (cited by Dumstrey) sutured the radial to the median; eighteen months later there was an excellent result as to both motion and sensation.

5. Neugebauer (sometimes quoted as Wölfler's case, cited by Dumstrey). After scar excision for contracture (bend of knee) peroneal paralysis was noticed. Anastomosis between the peroneal and (assumed) internal popliteal. Result negative eight months later.

6. Dumstrey (*loc. cit.*) implanted the ulnar into the median and got partial return of motion and sensation.

7. Trzebicky (cited in Chipault's "État actuel," etc.) sutured both ends of external popliteal to internal popliteal. Result satisfactory.

8. Trzebicky (*v. supra*), after resecting median (?) for sarcoma, implanted central (?) end into ulnar. Result satisfactory.

9. Trzebicky (*v. supra*), after resecting the ulnar for sarcoma, implanted its central (?) end into the median. The primary result was satisfactory, but the patient soon died of metastases.

10. Codevilla (*Clinica Chirurgica*, 1900, Nos. 9, 10). In a case in which the outer side of the knee was crushed, with the peroneal nerve

involved in the scar, the peripheral end of the latter was grafted into the internal popliteal. No improvement followed.

The results may be considered encouraging in five or six cases out of the ten (fifty per cent.).

Resection of Bone.—Since it is a foregone conclusion that if a divided nerve can best be made to heal under favorable conditions of approximation, and that removal of a segment of long bone will permit this approximation and guarantee the restoration of nerve continuity, it will be seen that the only practical question involved is " when is it justifiable to resect bone for this purpose?" It is not easy to answer this. The writer has found notes of seven cases, in the majority of which the bones were injured in the original traumatism which involved the nerve. In one of Keen's two cases resection was undertaken for false-joint following fracture. The references are as follows:

Keen (two cases), in Chipault's " État actuel," etc.; Rose and Carless (" Text-Book on Surgery"), and the older cases cited by Huber and other systematic writers (Lewin, Löbker, Bergmann, Wheeler).

Suture à Distance.—This consists essentially of bridging a defect with loops of catgut, etc. The positive results of Glück and Ehrmann are sufficiently well known. Recently, Keen (in Chipault's " État actuel," etc.) has reported a case with negative result.

Tubulization.—Although this method is extensively quoted in literature, the writer is able to find but one case in which it has been used to favor the restoration of nerve continuity to the exclusion of other resources. To promote nerve regeneration along the natural paths, surgeons have made use of barriers to prevent the fusion of nerve substance with the surrounding tissues. This is recorded many times in cases of simple nerve suture. So far as it refers to the principal method of securing continuity, the writer knows only of the case of Guelliot; this is cited by Ehrmann and others. As it resulted negatively, he judges that the theoretical operation of van Lair has never assumed a definite status in practice.

General Conclusions.—Although correction of the evils resulting from a gap in the continuity of a nerve is a matter of great importance in a given case, it hardly seems possible at this time to say definitely what form of bridging should be employed. More cases, and especially cases recorded later and better, are needed. Neuroplasty and implantation (anastomosis) are always available resources, and for the present it would seem that they should be preferred. Resection of bone may be advisable in selected cases. Transplantation of foreign grafts should be abandoned. It is hardly necessary to say that prognosis in an individual case should always be guarded, and that repeated operations may be necessary.

TOTAL AVULSION OF THE SCALP.[1]

BY ERNEST J. MELLISH, M.D.,

OF EL PASO, TEXAS,

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At about six o'clock A.M., September 23, 1903, Mrs. E. L., aged thirty years, while grinding grain with a belt machine, was caught by her hair (which was not hanging loose) by the perpendicular belt and was hoisted to the low ceiling and then dropped to the floor, leaving the entire scalp, together with all of the left ear, excepting the tragus, the antitragus, and the lobule, and all of the integument and subcutaneous tissue down to the fifth cervical spine behind and to the zygoma and bridge of the nose in front, dangling from the shaft. About half of the left lid and a portion of the right were pulled off with the scalp. A layer of the left temporal muscle was gone, and the cranial bones were denuded of periosteum in several places.

Dr. J. A. Samaniego saw the patient a few minutes after the accident and immediately applied a bichloride-of-mercury dressing. There was scarcely any bleeding and but little apparent shock. I saw her three hours after the accident, but did nothing except to recommend her removal to the hospital, which she entered the same day.

On the second day, twenty-six hours after the injury, shaving grafts (Thiersch) from the patient's thigh were transplanted to the lids and forehead up to the frontal eminences.

September 26, fourth day, grafts from the opposite thigh were placed on both temporal regions, on the mastoid regions, and on the neck for a width of six centimetres (two and one-half inches).

September 28, sixth day, a broad strip around the head was grafted from the husband's thigh. At this time a surface of about 180 square centimetres (seventy square inches), representing approximately half of the denuded area, had been covered with grafts.

[1] Read before the New Mexico Medical Society, May 11, 1904.

September 30, eighth day, a large surface was grafted, partly from the patient's thigh and partly from that of the husband. At the same time a large superficial slough was excised from the vertex.

October 5, thirteenth day, the remainder of the denuded surface was grafted from the thigh of a fourteen-year-old boy. At this time all of the surface was covered with epithelium excepting a few small areas of denuded bone and some spots of granulations between the edges of the grafts.

October 13, twenty-first day, all grafts were looking well, the entire surface where it was denuded being covered with movable skin, excepting the areas of denuded bone. These bone areas were already nearly covered with granulations. Thinking that the moist boric-acid dressings, which had been used up to this time, might cause too much maceration, I dusted the head lightly with boric-acid powder and applied a little carbolated vaseline instead. At the next dressing, two days later, I found that the vaseline dressing was macerating the new skin, so discarded it and applied a physiologic salt solution dressing. On the second day after this there was pus on the surface of the grafts, the amount being much larger on the grafts taken from the man and boy than on the ones autotransplanted. From this time on to the fortieth day from the time of the injury the grafts from the man and boy gradually dissolved off, despite all treatment applied. It was a molecular disintegration from the edges of the grafts. All of the autotransplanted grafts remained intact, and it is noteworthy that several of them formed islands, around which grafts from the other persons had been placed.

November 5, forty-third day, a large area was grafted from the patient's leg, and on the forty-eighth day the grafting was finished from her arm.

Sixty days after the injury the entire area which had been denuded was covered with movable skin, with the exception of three spots, the largest three centimetres in diameter, where a little of the bone was still bare. These soon cicatrized. (Figs. 1 and 2.)

The highest temperature (mouth) of the patient during treatment was 101° F., and the highest pulse-rate 116, on the second day. The temperature ranged from 99° to 100° F. up to the thirtieth day, after which it remained normal.

The above history tells only half the tale. Having gotten a denuded cranium completely covered with new skin, the next part of the battle is to prevent loss of considerable portions of the new skin from pressure or from microbic invasion. The pressure of the dressings across the forehead while the vertex was still under treatment, although the dressings were elastic and were carefully applied, caused a slight exfoliation of the stratum corneum, and microbic action carried the process through the still feebly resistant skin; but it healed readily, leaving a movable cicatrix.

After complete healing of the entire surface grafted, although the head was kept covered with a layer of absorbent cotton, held on with a muslin skull-cap, the stratum corneum would give way here and there, small crusts would form, and in a very short time thin seropus would lift the corneum and lucidum from the rete over a large area. Close attention prevented destruction of the deep layers so extensively as to require regrafting. If vaseline or lanolin were applied too freely the stratum corneum also gave way. Then, too, it was necessary to avoid the use of any but the mildest antiseptics, either in the form of powder or otherwise, when ulceration occurred. Since May there has been no further trouble. The patient wears a wig of her own hair. (Fig. 3.)

None but the Thiersch grafts were used in this case, because I considered this to be the best form of graft for the purpose. The grafts were about two and one-half centimetres (one inch) wide and from five to twenty centimetres (two to eight inches) long. For the skull I made the grafts rather thick, including, besides the stratum corneum, the stratum lucidum and the stratum Malpighii or rete mucosum, with the tips of the papillæ of the chorium, also a considerable portion of the chorium proper. The edges of the grafts should overlap slightly.

The surface from which the grafts are taken is shaved, scrubbed with alcohol, and then anæsthetized by the application of a mixture of ice and salt. Occasionally, the skin was frozen stiff, but not intentionally so, as a sufficient degree



FIG. 1.—Result from skin-grafting in case of avulsion of scalp. (Lateral view.)



FIG. 2.—Result from skin-grafting in case of avulsion of scalp. (Anterior view.)



FIG. 3.—Final result in case of avulsion of scalp; cicatrized area covered by wig.

of anæsthesia can be obtained short of freezing. The freezing seemed to make no difference in the vitality of the grafts, as none were lost primarily. The same hollow-ground razor used for shaving was, after cleansing with an alcohol sponge, employed to cut the grafts. No special knife is needed for this purpose. If the assistant holds the skin taut with a hand laid flat on each side of the limb, the graft can be cut in less time than it takes to write this sentence. The skin is wiped dry with a sterile gauze sponge, the razor dipped in physiologic salt solution, and the graft cut with a sawing motion.

Of course, grafts are always placed on an aseptic surface, either freshly denuded or granulating. Not many years since, it was thought that skin-grafts would grow only on a granulating surface. It is now well known that they will grow readily on raw aponeurotic surface and on raw bone.

In this case, as indicated in the clinical history, only grafts from the patient herself produced permanent skin, although none of the heterogeneous grafts were lost primarily. Bivings, quoted below, had a similar experience in his case. We must, then, conclude that heterogeneous grafting on the vault of the cranium should be avoided.

Complete avulsion of the scalp is sometimes attended with fatal hæmorrhage and shock, and the next danger is from infection, often resulting in death from sinusitis, meningitis, cerebritis, erysipelas, or long-continued suppuration. These conditions are, as a rule, avoidable.

I find nothing of account on the subject of avulsion of the scalp in any of the standard text- or reference-books. The only article in a goodly line of current literature at my disposal is one by W. Troy Bivings, of New York, entitled, "Avulsion of the Scalp, With Report of a Case" (*Philadelphia Medical Journal,* Vol. ix, p. 1020, June 7, 1902).

A noteworthy feature in all of the cases reported up to the time of Bivings's publication is the length of time required for the treatment. In one of Gussenbauer's cases, it required twenty months to effect complete healing, owing to the continual breaking down of the cicatrices. In this case 340 pieces

of skin were grafted, 270 of which healed in place. In another of his cases of complete avulsion, in a girl of sixteen years, death resulted a few days less than a year after the injury. Abbe, of New York, reported a case in which 12,000 grafts were planted in four years. In the winter of 1892–3, the late F. C. Schaefer exhibited a case before the Chicago Medical Society which, to the best of my recollection, had been under treatment for at least one or two years and was not yet healed. In the case reported by Bivings, in which approximately half the scalp was avulsed, healing was complete in about eighty days from the time of injury,—marking, apparently, a distinct advance in the management of such cases. The case here reported, involving the entire scalp, was completely healed in seventy to seventy-five days, and this time could have been reduced by about half through avoiding the use of heterogeneous grafts. Practically, the entire head was covered with new skin within three weeks after the injury, but the heterogeneous part of it disintegrated during the next three weeks.

As a matter of historic interest, I will quote from Bivings's article the following:

"In consulting the literature on this subject, I have been fortunate enough to discover an article entitled, 'Remarks on the Management of Scalped Head,' by the late Felix Robertson, M.D., which was published in the *Philadelphia Medical and Physical Journal* years ago, from which I quote the following:

"'In the year 1777, Fred Calvit was badly wounded and nearly the whole of his head skinned. Dr. Vance of the Long Islands, of Holsteins, was sent for and stayed several days with him. The skull bone was quite rotted and began to turn black in places, and, as Dr. Vance was about to leave Calvit, he directed me (as I was stationed in the same fort with him) to bore his skull as it got black, and he bored a few holes himself to show the manner of doing it. I have found that a flat-pointed, straight (shoemaker's) awl is the best instrument to bore with, as the skull is thick and somewhat difficult to penetrate. When the awl is nearly through, the instrument should be more lightly borne upon.' The time to quit boring is when a reddish fluid appears on the point of the awl. I bore at first about one inch apart, and as the flesh appeared to rise in these holes I bored a number more between the first. The flesh will rise considerably above the skull and sometimes raise a black scale from it, about the thickness of common writing-paper. It is well to assist in getting off the scales of bone with the awl. These scales are often as large as a dollar, sometimes

even twice as large. It will take at most two weeks from the time of boring for it to scale. When the scale is taken off at the proper time, all beneath it will appear flesh, like what we call proud flesh, as if there was no bone under it. The scalped head cures very slowly, and if this kind of flesh rises in places higher than common, touch it with blue-stone water and dress it once or twice a day, putting a coat of lint over it every time you dress it, with a narrow plate of ointment. It skins over remarkably slow.'

"'In 1768, I saw a young man in South Carolina, who had been scalped eight years before that time, and about twice the size of a dollar of the bone of his head was perfectly bare, dry, and black. I am persuaded that, had his skull even then been bored, he might have recovered of the wound, which put an end to his life about a year after I saw him. The naked portion of the bone rotted or mortified and exposed the substance of his brain, a very considerable quantity of which issued out at the opening at his death.'"

Bivings reports that after careful and systematic research he was unable to find more than thirteen cases of scalp avulsion recorded, and several of these were incomplete in character, in so far as the scalp was only partially destroyed. "Of the thirteen cases, one case was reported by Hyrtl, two by Gussenbauer, two by Robertson, one by Sutliff, one by Warren (J. C.), one by Warren (J. M.), one by Lucas, one by Gerok (M.), one by Abbe, one by Sick, one case (under treatment) in Gouverneur Hospital."

Bivings's case in brief. Girl aged fourteen years, white. Injury, October 24, complete avulsion of the scalp, together with the periosteum, covering both the parietal and a part of the occipital bones. Unconscious when first seen; marked concussion; some hæmorrhage from branches of temporal, posterior, auricular, and occipital arteries. Wound surface dirty and greasy. Thorough cleansing, bichloride applied, then a wet dressing of aluminum acetate; ice helmet. Bones exfoliated in about two weeks. The latter part of November a bilateral bronchopneumonia had developed from pertussis, which she had at time of injury; patient very ill for five days; temperature, 105.5° F. Three skin-grafting operations, the last one on January 1. First grafting from father's thigh, grafts one by three inches in size. They were Thiersch grafts and the majority of them grew. Second operation was a combination of the Krause and Reverdin methods; skin taken from thighs of eighteen-year-old boy; none grew. Next tried egg skin and frog skin, and Lusk's method; all failed. Patient then had bilateral mumps, followed by membranous colitis; very ill. Third operation, January 1; Thiersch grafts from patient's thighs, flabby granulations having been curetted away four days previously. Two weeks later head entirely covered with skin.

TRAUMATIC ABSCESS OF CEREBRUM.

RECOVERY AFTER TREPHINING AND DRAINAGE.

BY ERNEST F. ROBINSON, M.D.,

OF KANSAS CITY, MISSOURI.

THE following case of brain abscess is reported because of its interesting diagnostic features, and also because it illustrates to what an extent operative interference may be carried in dealing with brain tissue itself, provided the principles of asepsis are followed.

Temporosphenoidal Abscess following Gunshot Wound of Ear; Trephining; Drainage with Rubber Tube for Three Days; Recovery Complete, without Paralysis or Loss of Cerebral Function.

May 10, 1904, Mrs. M., twenty-eight years old, a slender German woman, during a period of mental depression shot herself with a 32-caliber revolver in the right ear. Four days after the injury she was seen in consultation with her attending physician, Dr. Barnett, of Rosedale. She had reacted fairly well from shock, but lay in a semiconscious condition. The wound just behind the right external auditory meatus was badly powder-burnt, but had suppurated very little. Under chloroform anæsthesia the ear was thrown forward by a curved posterior incision and a badly battered 32-caliber bullet, together with fragments of lead and bone, removed. The bullet had shattered the petrous portion of the temporal bone; only a thin shell of bone remained between this cavity and the cerebral contents. The wound was cleansed, packed through the bullet wound, and the incision closed with sutures. There was paralysis of the right side of the face and inability to completely close the right eyelids, due to injury to the seventh nerve. The operative wound healed by primary union, and the gunshot wound was clean and had almost closed when the patient was turned over to attending physician.

Six weeks after the injury, June 23, 1904, I again saw the

patient, owing to some unusual symptoms that had recently developed. She was seated in a chair by the bedside, with one hand against the right side of her head. Her physician stated that she would remain in the same position for hours, or when put to bed would lie in one position, usually on her side, without moving. When aroused she complained of frightful headache, chiefly over the right side of head, forehead, and right eye.

Her mental faculties were decidedly dulled. When spoken to she would be slow in replying, often waiting so long that it was thought she had not heard or comprehended, when suddenly she would answer shortly but correctly. A long reply she would not make, and often she would not reply at all, even to a simple question, apparently going off into a doze. Sometimes she would not finish her sentences; all her mental processes seemed dulled or delayed, and she had not the power of sustained attention. She was mildly delirious at times. Her temperature was subnormal, and her pulse was slow but weak at 52 per minute.

The pupils were markedly unequal; the right dilated but reacted slowly to light. Nystagmus was present. No changes in the fundus could be detected. The patient had vomited several times recently, but there was no persistence of this symptom, and it was difficult to determine that it was of central origin. The tongue was coated and the breath foul. The tongue deviated markedly to the left side. There was no paralysis beyond that of the seventh nerve, which had been destroyed by the original gunshot wound. The patient was extremely weak. She voided urine normally, but was habitually constipated. There had never been any rigors or convulsions, but emaciation was extreme.

It seemed probable that an abscess of the temporosphenoidal lobe had developed, either through an infection which had extended from the old gunshot wound, or (which seemed more probable, considering the clean conditions of the wound) that the severe local concussion which the temporal lobe had received at the time the shot was fired had so devitalized an area of brain substances that a local abscess resulted. This latter opinion was found correct.

Patient was immediately sent to St. Joseph's Hospital, where, with the assistance of Dr. Barnett and Dr. C. L. Spaulding, the skull was opened. An inverted U-shaped incision was made, beginning at the angle of the mastoid, extending upward for

about two and one-half inches, and then curving forward and downward to a point three-fourths of an inch anterior to the middle of the zygoma. The bone was laid bare, hæmorrhage was checked, and a trephine placed one inch above and anterior to the external auditory meatus. This afforded access to the sphenotemporal lobe at its base, and was admirable for exploration and drainage. The trephine opening was slightly enlarged with rongeur forceps, and a meningeal vessel of fair size was ligated with catgut on a fine curved needle. The meninges were opened, when the brain bulged into the wound, but did not pulsate. Its surface was normal. A large, smooth bullet probe and, later, a grooved director were passed under the temporal lobe, and also between the meninges and the bone, but failed to find pus.

Consequently, a medium sized aspirating needle was thrust into the brain substances downward and forward towards the petrous bone. At a depth of about one inch it encountered pus. The needle was left *in situ* and a grooved director was passed along it as a guide, and about two drachms of pure yellowish pus were evacuated. A small rubber drainage tube was inserted most carefully into the brain substances down to the point where pus was encountered. There was no distinct abscess wall. The free end of the tube was brought out through a button-hole in the skin flap. The brain substances were injured almost none at all.

The wound was closed, and a small wick of gauze was inserted at the posterior angle of the wound down to the meninges. There was very little shock. Patient left the table with a pulse of 60 and of fair quality. Morphine was given, and she had a very comfortable night. She was not nauseated. The following morning she was conscious, and asked about her husband and doctor, and specified the kind of food she wanted. Pulse, 66; temperature, 99° F.

During the day she lay quiet, but could be aroused. At these intervals she seemed conscious. Her condition remained practically unchanged until the third day, when her mental stupor deepened and symptoms of cerebral pressure developed.

The wound was immediately dressed. The drainage tube (which had ceased discharging) was removed, and the track of the tube gently irrigated with sterile water. The wound was

perfectly clean. The next morning the patient was conscious. She talked rationally to her nurse, and was reading a German prayer-book when visited by the house doctor. The tube was evidently causing the pressure symptoms. From this on she made an uneventful and rapid recovery.

An interesting psychological point in reference to her convalescence is the fact that the patient remembered nothing that occurred from the date the injury was received until a few days prior to her departure from the hospital.

On July 5 she returned home without a single mental symptom. Her further progress towards recovery was uninterrupted.

FRACTURE OF THE BASE OF THE SKULL.

A CONTRIBUTION BASED ON THE CLINICAL AND PATHOLOGICAL RECORDS OF FIFTY CASES.

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OF BOSTON, MASS.,

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THIS study has received fresh impetus from the recent work of Rawling (*Lancet*, April 9, 16, 23, 1904), who devotes special attention to the course followed by lines of basal fracture, and gives certain rules which he states will in the great majority of cases be found to be correct, though exceptions may occur. The accompanying diagrams represent approximately the lines indicated by this author. (Fig. 1.)

Among other points of interest in Rawling's communication may be mentioned the following: The sella Turcica was implicated in 70 per cent. of cases; the line of fracture is extremely liable to follow a suture, either causing its separation or cutting across its irregularities; Battle's view that lines of fracture are apt to cease at foramina is erroneous, as well as the idea that the optic foramen is extremely liable to implication; profuse and persistent bleeding from the ear is sufficiently indicative of middle meningeal hæmorrhage to suggest operation over this artery without other sign of its rupture.

These views are in some ways diametrically opposed to those usually accepted; for example, the general consensus of opinion regarding the lines of fracture, apart from the statement that a few general directions are followed, is thus expressed in Dennis' "System of Surgery," "At all events, the majority of basal fractures follow no predetermined rule."

With the view of contributing a number of consecutive observations towards the settlement of this question, as well as of studying other points of interest, I have gone over the autopsy reports of fifty cases of basal fracture, through the

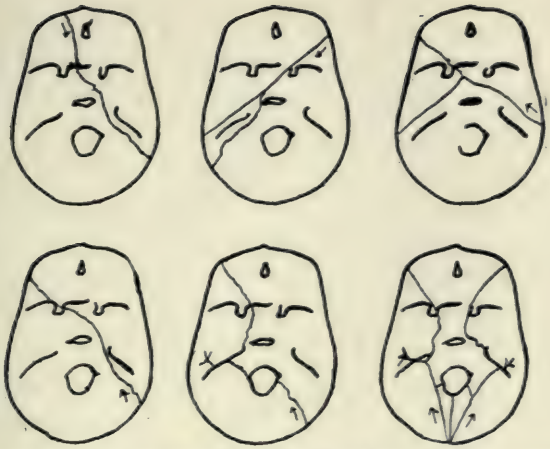


FIG. 1.—An approximate representation of Rawling's lines of fracture resulting from impacts of various directions.

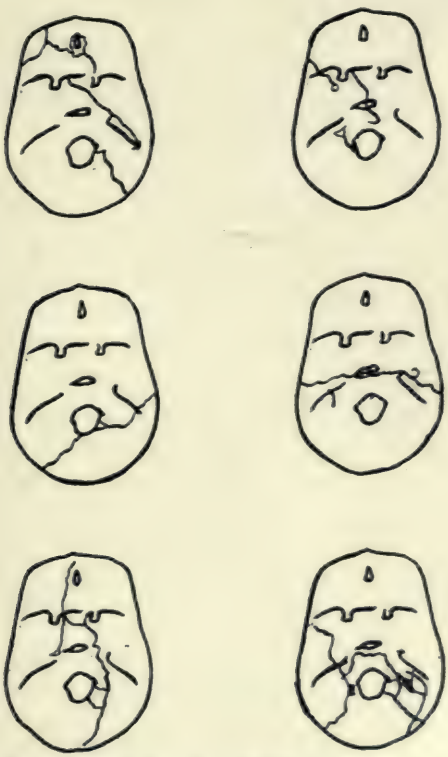


FIG. 2.—Approximate representation of von Wahl's bursting fractures as pictured in Dennis' "System of Surgery."

courtesy of Dr. Wright, pathologist at the Massachusetts General Hospital, and of Dr. Mallory, pathologist at the Boston City Hospital. Diagrams of all are submitted. It is not claimed that the exact course of each fracture is pictured, but the lines of fracture were in general so carefully recorded as to be susceptible of fairly accurate diagrammatic representation, excepting in minor particulars. In one case, that in which all the fossæ were invaded (Fig. 12), the statement was made that the fracture on the left was in the shape of a C, beginning in the occipital and ending in the orbital fossa, without indicating its exact course from one to the other; in this instance, therefore, the course of fracture should not be regarded as at all accurately represented except in its limits.

A word will be in place regarding the method of production of basal fracture. The view held by earlier writers that fractures of the base resulted from *contre-coup* was displaced by the irradiation theory of Aran (*Arch. gén. de Méd.*, 4th Series, T. vi, p. 180) (fortified by Hewitt, Bergmann, and others), who established the fact that in case of fracture resulting from a blow upon the vault the line of fracture tends to enter the nearest fossa, and that it is impossible experimentally to produce fracture by *contre-coup*. This view now generally obtains, with the modification that lines of least resistance are followed, as first suggested by Félizet, rather than the shortest anatomical route as maintained by Aran. The so-called bursting fracture of Hare (*Lancet,* February 4, 1888), Messerer, Hermann, and von Wahl presupposes a pressure upon the side of the skull producing a fracture of the base, much as pressure on the opposite poles of a spherical body causes it to burst across its equator. (Fig. 2.)

Rawling explains the so-called bursting fractures at the base by a modification of the irradiation theory. According to his view, if a man receives a violent impact on the back of the head, the force, though greatest at the point of impact, may be insufficient to overcome the resistance of the occipital bone in this region, and yet, when transmitted to the more delicate bones of the base, prove sufficient to cause their fracture.

Probably both these principles come into play upon the complicated structures of the skull under the various conditions of impact against bodies of various sizes and shapes. A few primitive experiments will serve to show that the question is not simple even when applied to fairly uniform bodies subjected to various forms of trauma.

If an orange is squeezed between the palms until it gives way, the crack appears across the equatorial line midway between the hands, and extends in both directions. This result is constant in whatever position the orange is held, thus eliminating, or even overcoming, the influence of grain. (Figs. 3 and 4.) This illustrates the bursting fracture. If, however, the orange is suspended in the air, or laid upon the table and struck a violent blow on one side with a stick, it breaks at the point of impact and shows no evidence of bursting force; again, if a watermelon is laid on the ground and struck on its side, it gives way at the point of impact, and a crack extends from this point in the same direction. In other words, the region last to give way under steady compression between two forces is the first to give way under a blow.

If, now, instead of suspending the orange we impale it upon a stick, thus weakening one portion of the rind, and strike its side upon the floor, a crack is likely to appear at the point where the rind is perforated by the stick. This might suggest force transmitted from the point of impact to the weakest part rather than bursting force; but if we drop an orange to the ground, a bursting crack is apt to appear at the equatorial line, or between the point of impact and the equatorial line, on one or both sides, without fracture at the point of impact; or again, if we drop a watermelon to the ground, a crack, suggestive of bursting force, appears across its equator as well as depression of the region of impact and radiating cracks about this region. In the case of the watermelon the crack tends to go around the end, apparently the line of least resistance. A tendency to bursting fracture is present then, when the body, after swiftly moving, is suddenly brought to a standstill, though no such tendency appeared when it was hang-



FIG. 3.—Simple illustration of bursting fracture.



FIG. 4.—Simple illustration of bursting fracture.

ing quietly, and the implement of trauma was moving swiftly. This is doubtless because the momentum of the falling body causes its upper portion to act as a counter-compressant. The bursting principle, as well as the principle of transmitted force, may, then, have played a part in the case of the orange impaled upon the stick and struck upon the floor.

These simple experiments suggest that it is important to distinguish between falls on the head and blows upon the head from weapons, as well as to distinguish between both these conditions and a gradual pressure upon both sides of the skull.

These experiments, though suggestive, are introduced not with an idea that the structure of the skull and the conditions of actual trauma are even approximated, but with a view of illustrating the difficulties of the question with regard to objects of simplest structure subjected to the simplest forms of trauma, and to warn against too readily accepting any single explanation for the complex conditions found in basal fracture.

The following case, for which I am indebted to Dr. Wolberg, tends to show that even when compression occurs, if we have at the same time to do with a sharp blow from one of the compressing surfaces, especially if this surface offers a projection, the signs of greatest violence may occur at the point of impact. It also introduces another factor, namely, the age of the individual.

CASE.—A boy of about twelve jumped upon a rapidly moving hand-car. His head was caught between the cross-bar of the working-beam and the edge, or corner, of a tool-box. The result was a depressed fracture of the frontal bone, which rested on the tool-box.

Experiments on the cadaver promise little towards solving this problem. The question in dispute is not what occurs when the skull is subjected to violence, but what mechanical principles underlie the phenomena, of which we have already more evidence than we can analyze. Perhaps the following would be a reasonable working hypothesis: When the trauma results from (1) pure compression, the bursting principle alone, or at

least predominantly, underlies the fracture; (2) from a sharp blow, the violence is greatest at the point of impact and the transmission principle predominates; (3) from a fall, both factors take part. Between these three forms of trauma, *i.e.*, compression, blow, and fall, many gradations may occur, complicated still further by the character of the object causing impact and the age of the individual.

Possibly the addition of bursting force to the danger may partly explain the prevalence of falls over blows in the etiology of basal fracture, as illustrated by Graf's cases, in which sixty-three out of ninety resulted from falls.

FIFTY CASES.

The study of these fifty cases confirms the statement of Rawling that the impact is oftenest received in the basal plane, whether on the frontal or occipital region or upon the side of the head. There was no suggestion of the *contre-coup* of early writers. In fact, in the four cases resulting from blows on the vertex the line of fracture was continuous from the vertex to the base. When the line of fracture extended from any part of the vault, it generally entered the nearest fossa and extended in the direction of the force applied.

In twenty-two of the fifty cases, as will be seen from the appended diagrams, the lines of fracture either followed or suggested the lines of Rawling, as well as von Wahl's lines of bursting force, and fall almost invariably between the natural buttresses of the skull, indicated by various anatomists, extending from the vault to the base in the mid-frontal, external angular, mastoid, and occipital regions.

These results tend, therefore, to support the statement that basal fractures are prone to follow lines of least resistance.

The diagrams of the other twenty-eight cases, however, show results so variable as to make it plain that the exceptions to Rawling's lines, far from being occasional, are in the majority.

The sella Turcica was found a frequent seat of fracture, being implicated in eighteen cases (36 per cent.) from force

applied in all directions. The petro-occipital and masto-occipital sutures were also frequently involved, oftenest from violence in the mastoid region. The petrous portion of the temporal bone furnished a very frequent seat for fracture, generally in the transverse direction through the region occupied by the aural mechanism. This bone was fractured transversely twelve times, longitudinally four times. There was no example of the fracture, described by Rawling as a common form of middle fossa fracture, running through the external auditory canal on its way to the sphenoidal sinus, though there were several in which the fracture ran parallel with and anterior to the petrous portion. Nor was there corroboration of the observations of Honel (quoted by Dennis), that in seventeen out of the twenty-one cases of transverse fracture from blows on the side of the head the petrous portion was traversed longitudinally.

The orbital fossa was fractured in fourteen cases, five times from direct frontal violence, eight times from external angular or temporal violence, once from mastoid violence, in no case from occipital violence. The occipital fossa was implicated sixteen times, twice from frontal violence; the middle fossa ten times. There were seven instances (14 per cent.) of fracture limited to the base, two following blows on the vault in the horizontal plane, and two from unknown violence. In the five cases in which the direction of the violence was known, the line of fracture was generally in the same direction.

Comparisons of frequency of fossa implication with the records of Hewitt and Bergmann are as follows:

Anterior fossa alone, 0 per cent.; Hewitt and Bergmann, 12 per cent.
Middle fossa alone, 20 per cent.; Hewitt and Bergmann, 43 per cent.
Occipital fossa alone, 16 per cent.; Hewitt and Bergmann, 15 per cent.
Two or more fossæ, 64 per cent.; Hewitt and Bergmann, 30 per cent.

In studying these records, one finding impressed itself upon me which, so far as I am aware, has not been specially noted, namely, the frequent disintegration of brain tissue on the under surface of the frontal lobes posteriorly, and the under surface of the temporosphenoidal lobes anteriorly, that is, the

region bordering on the fissure of Sylvius. (Fig. 5.) This can only be due, it seems to me, to the impact of these regions against the lesser wing of the sphenoid bone, which fits into the fissure of Sylvius and separates these lobes.

Subconjunctival hæmorrhage led in one case to a diagnosis of basal fracture, not confirmed by autopsy. This will serve to remind us that subconjunctival hæmorrhage is not an infallible sign of fracture other than fracture of the outer wall of the orbit.

Regarding the direction of the blow in these instances, the only data to guide me were the statements of witnesses found in the clinical records, and the marks of external violence as recorded either in the clinical or the post-mortem records, or both. It is not claimed, therefore, that the conclusion arrived at regarding the direction of the blow was in all cases accurate; in fact, it is manifestly difficult and often impossible to determine the exact direction in which the skull receives the impact, even though the seat of the blow may be easily approximated. The appearance of various contusions in the same case may even prevent deciding upon the seat of the violence which caused the fracture. I was surprised to find several cases in which it was recorded that no external sign was found either by the clinical or the pathological examiner. There is a prevailing impression that this state of affairs is very rare, and results only from the use of some such instrument as the sand-bag.

The study of the cases in which the direction of the violence was known, together with that of other cases on record, enables us to judge the probable direction in the other cases, for it seems that the general direction of the fracture is that of the violence. This knowledge may prove of assistance in medicolegal inquiry, even though its clinical application may be limited.

In eleven cases the line of fracture was definitely stated to cease at a foramen; those mentioned were the foramen magnum, the jugular foramen, the foramen rotundum, the foramen ovale, the foramen spinosum, and the anterior condyloid foramen.



FIG. 5.—The dots show region of frequent disintegration of brain substance, due probably to impact against wing of sphenoid bone.

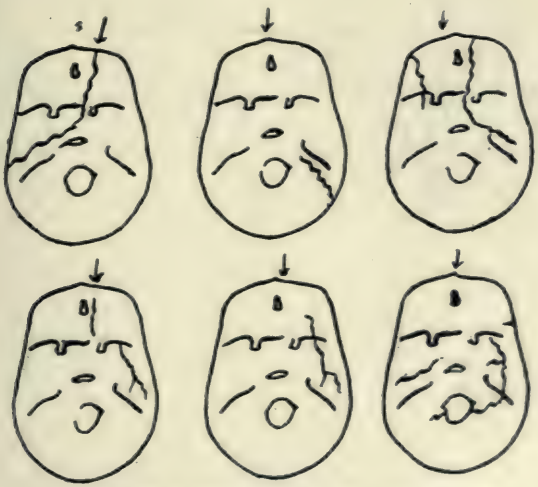


FIG. 6.—Lines of fracture resulting from frontal violence.



FIG. 7.—Lines of fracture resulting from violence in region of external angular process of frontal bone.



FIG. 8.—Lines of fracture resulting from violence in mastoid region.



FIG. 9.—Lines of fracture resulting from lateral violence.

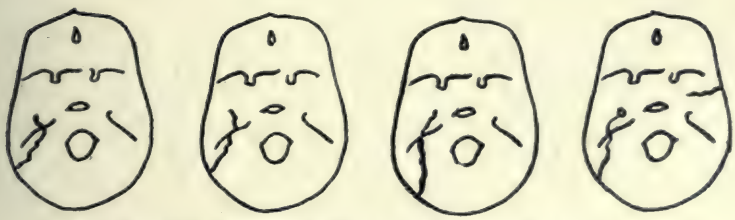


FIG. 10.—Lines of fracture resulting from blows in median line of vault.



FIG. 11.—Lines of fracture resulting from occipital violence.



FIG. 12.—Lines of fracture resulting from violence of unknown direction.

The optic foramen was traversed in three out of the fourteen cases implicating the orbital fossa (21.4 per cent.), once on both sides. This does not quite justify the statement that the lesion is rare, but falls short of the frequency noted by Hoelder, who states that 50 per cent. of frontal fractures involve this foramen. Rawling's observation regarding the comparative immunity of the great vessels and the nerves of the base was borne out in a striking manner.

In one case all three fossæ were invaded on both sides, furnishing the second case of this lesion recorded as far as I am aware, the first being reported by Phelps (*New York Medical Journal,* January 14, 28, 1893).

The following are the diagrams grouped according to the estimated direction of the violence: (Figs. 6 to 12.)

The clinical records of hospital cases are less reliable than the pathological reports, unless we are sure that the observations regarding, for example, the pupils and the reflexes have been always made by those skilled in these branches; they offer much of interest, however, viewed with this reservation.

PUPILS.

The clinical records of these cases emphasized the fact that among the symptoms of basal fracture pupillary disturbance must be reckoned among the most constant and reliable, both for diagnosis and prognosis.

In the forty-four cases in which the condition of the pupils was noted, only thirteen were normal in size and reaction. The variety of the disturbance is illustrated by the fact that in seven cases both were small; in five, both large; in sixteen they were unequal (in three, one pupil contracted; in nine, one dilated; in one, both contracted, but unequally; in one, the left dilated and non-reacting, the right contracted and reacting; in two no note was made on this point); in three, the pupils were alike, but did not react to light. In a large number of these thirty-one cases it was noted that one or both pupils failed to react to light.

The importance of this point in prognosis is accentuated

by the observations of Lovett and Munro (*Medical and Surgical Records of Boston City Hospital,* 1889), who find that the pupils failed to react in thirty-nine out of fifty-three fatal cases of basal fracture in which they were recorded, whereas they failed to react in only one of twelve cases with recovery after the same diagnosis had been made and the pupils recorded. Similarly, Nichols (*idem.,* 1895) states that in fifty-four cases of head injury with non-reacting pupils, forty-seven died, and that in the twenty-four cases diagnosticated as basal fracture, *all were fatal,* from which he justly concludes that this is the most unfavorable single symptom.

Among the authorities laying special stress on the pupils, Phelps (*New York Medical Journal,* 1893) describes them as "variable, unsymmetrical, dilated, or contracted."

The disordered pupil is not susceptible of easy explanation; perhaps various factors take part. *The generally accepted paralysis of the third nerve causing dilatation of the pupil is untenable,* inasmuch as it is hardly credible that the ciliary fibres of this nerve should be so constantly affected without other sign of third nerve paralysis, to say nothing of the fact that the situation of this nerve in the wall of the cavernous sinus would naturally tend to protect it from injury.

The substitution of Rawling is hardly more acceptable. He attributes the disordered pupils to trauma affecting the cortical centre for contraction of the pupil, and states that the pupil is first contracted, then dilated.

One fact alone tends to eliminate cortical injury as playing a prominent part in the disordered pupils of basal fracture, namely, in most pupillary changes due to cortical influence, whether experimental or pathological, the alteration is bilateral and accompanied by other muscular phenomena as ptosis or conjugate deviation.

Doubtless various factors play a part in producing the altered pupils in this lesion, but *if disorder of any simple mechanism is to be credited with the production of the Hutchinson pupil or the other pupillary changes noted, the only lesion*

worthy of this place is disturbance, irritative or paralytic, of the intracranial fibres of the ciliospinal tract.

This tract after leaving the cervical sympathetic passes into the base with the carotid plexus, thence forward by the ophthalmic division of the fifth and its nasal branch, having first passed over the Gasserian ganglion. The fact is established that irritation of this tract causes dilatation, and its destruction contraction, of the pupil. The existence of dilator muscles in the iris seems to have been now fairly established (Langley and Anderson, Grenert, Devries, *et al.*). The fibres of the ciliospinal tract through which these muscles are presumably innervated would seem at least equally accessible with the third nerve to injury either from fracture of the base, or from uncomplicated middle meningeal hæmorrhage. In fact, I am inclined to think that at one point in their course they are peculiarly susceptible to injury, namely, at the apex of the petrous bone, in the region where the force transmitted along this buttress is suddenly interrupted and deadened by the buttress coming to an end. Nor is this tract open to the objection that other than pupillary symptoms should follow its disturbance, for the only other symptoms to be expected would be those of vasomotor disorder; such symptoms are by no means wanting, though they have lacked special study.

The proposition that initial contraction precedes dilatation can hardly be regarded as established. The following case which came under my observation within fifteen minutes of the accident would certainly point towards dilatation as a primary symptom.

Case.—A teamster fell from his wagon, striking violently upon the back of the head. The accident occurred at six P.M., near the Massachusetts General Hospital, and he was brought immediately to the accident-room, where I saw him. There was extensive tear of the scalp in the occipital region. The patient was partially conscious, though unable to answer questions coherently; he was restless and combative, apparently alcoholic.

The left pupil was widely dilated and did not react to light. The right was normal. The epigastric, abdominal, patellar, and

plantar reflexes were wanting on both sides; there was no Babinski. The cremaster reflex was present and lively.

He was admitted to the House in Dr. Cabot's service, where I saw him again the next morning at nine o'clock. The pupils were then practically alike, and the left as well as the right reacted perfectly to light. All the reflexes had returned and had become active.

There was no bleeding from ears or nose, no subconjunctival hæmorrhage, no ecchymoses of lids or other region. The patient was kept under careful observation for three days, when he was allowed to go home. No further cerebral symptoms have appeared.

In casting about for an explanation of the dilatation and immobility of the pupil in this case, we must assume a unilateral and definitely localized, though temporary, injury. To me none seems more plausible than irritation by injury of the ciliospinal fibres on one side.

We may well leave this question still open when we realize the maze of uncertainty regarding even the course of the fibres, and the situation of the centres, constituting the primary reflex arc, as recently exhaustively reviewed by Thomas (*American Journal of the Medical Sciences,* December, 1903).

REFLEXES.

In the twenty-seven cases in which the condition of the knee-jerk was specified, it was stated to be normal in twelve, increased in seven, diminished in two, and wanting in six; in one case it was noted as still absent at the end of five days. In one case, definitely spastic, at the first examination the knee-jerks were exaggerated and the Babinski sign was present. The cremaster reflex was noted in two cases only, present in both. In three cases the general statement, " reflexes absent," appeared, without specifying the reflexes tested. This was an unfortunate omission, for the condition of the cremaster reflex would have been of interest in view of the exemption of this reflex from the general loss in the case of concussion and con-

tusion above cited. Further observations on this point are desirable.

Whatever lesson is to be drawn from the reflexes in these cases, it should not be regarded as specially diagnostic of basal fracture, but as resulting from violent jarring of the intracranial contents, accompanied perhaps by local bruising and by hæmorrhage, either limited or extensive.

The number of observations was small, but the proportion of cases in which the direction was towards lessening or loss was noteworthy. Doubtless some, at least, of the cases of exaggerated reflex represented a secondary condition; indeed, I suspect that in every instance the first result of a violent jar is a tendency towards lessening or loss of reflexes, even though sometimes speedily followed by their return and under certain circumstances by their intensification. The case of concussion and contusion above cited certainly shows that the reflexes (excepting the cremaster) may be wanting immediately after cerebral trauma, only to become extremely active within a few hours.

To attribute the lessened reflexes to shock of the spinal cord seems hardly satisfactory. In fact, if all the reflexes have their controlling mechanism in the cord, it is hard to see why the cremaster reflex should remain active while the rest are abolished. In case it proves that the cremaster usually escapes, it would seem to me far more probable that, while the mechanism controlling the cremaster reflex may have remained purely spinal, those controlling the other reflexes have passed cerebralwards in the higher development of the nervous system, as advocated by Grasset and others, though it seems probable that there is no single centre for the reflexes. Perhaps, as my colleague Dr. Paul has suggested, individuals are divided into those with predominating spinal reflex control, and those with predominating cerebral element, just as they are separated into visuels and auditifs on the sensory side of the language mechanism.

The exaggeration of reflexes is not so easy of explanation under Grasset's supposition; perhaps in some cases, as after

simple concussion, the reaction brings about an exalted irritability of the cerebral mechanism after recovery from the paralyzing effect of the trauma, or perhaps again, as I have suggested in connection with the exaggerated reflexes of chronic spastic paralysis, the lower spinal centres are ready to take up their latent function, and this even in an exaggerated manner when freed from cerebral control, especially under the stimulus of irritation, as by hæmorrhage, of the pyramidal fibres.

THE RELATION OF PROFUSE AND CONTINUED BLEEDING FROM THE EAR TO MIDDLE MENINGEAL HÆMORRHAGE.

The views of Rawling on this question are of sufficient practical bearing to justify careful analysis, and this I have made on the cases at hand with the following result. Bleeding from one or both ears was noted in twenty-one cases (in marked contrast to the ninety cases of Graf (*Deutsche Zeit. f. Chir.,* Band lxviii, p. 464) in which it appeared in seventy-seven instances). In most of the cases in which bleeding from the ear was noted, it seems to have been temporary and small in quantity. In three cases it was described as profuse, and in one case as persistent. *In none of these four cases was middle meningeal hæmorrhage found on autopsy;* nor, indeed, evidence of rupture of any of the large vessels, either arterial or venous; conversely, *middle meningeal hæmorrhage was found in nine cases, in eight without bleeding from the ear, in one with slight bleeding.*

RECAPITULATION.

1. In the majority of the cases the basal fracture resulted from impact received in the horizontal plane of the skull, whether upon the frontal or the occipital region or upon the side of the head.

2. While certain of the basal fractures extended from the vertex, there was no suggestion of the *contre-coup* of earlier writers.

3. The line of fracture tended to enter the fossa nearest the point of impact, and to extend in the general direction in which force was applied.

4. The lines of fracture in traversing the base tended to follow lines of least resistance, and in twenty-two of the fifty cases these lines corresponded more or less accurately to those indicated by Rawling, but the exceptions were too marked and too constant to allow the establishment of fixed rules.

5. The sella Turcica was implicated in 36 per cent. of the fractures. The petro-occipital and masto-occipital sutures furnished common lines of least resistance. Fractures extending across the base tended to run parallel to the petrous portion of the temporal bone and through the sella Turcica. Certain blows on the occiput tended to cause a line of fracture extending to the jugular foramen or across the petrous bone. The portion of the petrous bone containing the auditory apparatus showed itself peculiarly liable to fracture, more often transversely than longitudinally.

6. In seven cases (14 per cent.) the fracture was limited to the base after vault impact in the horizontal plane. Neither Rawling's theory of transmitted force nor the theory of bursting fracture of von Wahl and others suffices alone to explain these cases. The results of experiments with bodies of simpler structure would suggest that the bursting principle predominates in pure compression of the skull, and the principle of transmitted force in case of blows, while both play important parts in case of falls.

7. The orbital foramen was implicated in 21.4 per cent. of the cases of orbital fossa fracture.

8. Inequality and immobility of pupils, or both, furnish the most frequent and unfavorable sign of fracture of the base. In the forty-four cases in which the pupils were recorded, they were normal in only thirteen.

9. Injury to the ciliospinal tract in its intracranial course is a more probable cause of the Hutchinson pupil and the other pupillary changes than injury to the third nerve or to the cortex, though no single lesion explains all cases.

10. The reflexes may be lessened or lost in fracture of the base, as in any case of violent jarring of the brain. On the other hand, they may be increased even to spasticity, probably through direct pressure on the pyramidal tract as by hæmorrhage. It is probable that the initial result of the impact in all cases is a tendency towards lessening or loss of the reflexes.

11. Profuse and persistent bleeding from the ear does not suggest middle meningeal hæmorrhage. No middle meningeal hæmorrhage was found in the cases of profuse and persistent bleeding, and, conversely, hæmorrhage from this artery occurred eight times without, and once with only slight, bleeding from the ear.

LIGATION OF BOTH COMMON CAROTID ARTERIES.

REPORT OF A CASE IN WHICH THE RIGHT COMMON CAROTID ARTERY WAS LIGATED FOR INOPERABLE SARCOMA, WITH TEMPORARY IMPROVEMENT; LIGATION OF THE LEFT COMMON CAROTID SIXTY-NINE DAYS AFTER THE FIRST OPERATION.

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THE report of the following case is from the service of Dr. A. C. Wood, in the Philadelphia Hospital.

J. S., colored; thirty-two years old; laborer; was admitted to the hospital June 1, 1903, with the history that two years ago, shortly after beginning to work in a chemical factory, his nose began to bleed at intervals, and he began to have pains in his head. These symptoms have continued to the present time with increasing severity. He has lost weight and strength. For the past six or eight months his right eye has gradually become more and more protruded.

On admission to the hospital he complained of weakness, pains in his head, difficulty in walking, and great difficulty in masticating and swallowing food. In appearance he was poorly nourished. The right eye extended beyond the bridge of the nose. On the right side, evidently involving the pterygomaxillary region, a mass was visible protruding from behind the lower jaw, and apparently attached to it. The jaw protruded somewhat near the angle, and considerable induration of the soft tissues existed below the jaw.

Examination of the nose and mouth on the affected side showed that the breathing was occurring almost entirely by the mouth. The right nasal cavity was completely obstructed by a mass of swollen tissue, which bled freely when touched by instruments. The turbinates on this side were not visible. The left nasal cavity was somewhat obstructed, but not entirely. That

the tumor was growing forward and inward was shown by the fact that the eye was protruding, and that the nose and mouth were involved by the growth on that side. Another small mass was evident in the parotid region of the opposite side, not involving the jaw.

The diagnosis of sarcoma was made. It is recorded in the notes that on June 10 the patient was prepared for operation, but that this was abandoned because of the difficulty in administering the ether.

After studying the case carefully, it was decided that the only justifiable operation was ligation of the common carotid artery, not with the idea of effecting a cure, which was manifestly impossible, but of affording at least temporary relief.

On July 22 Dr. Wood ligated the right common carotid under local anæsthesia by the Schleich method because of the previous difficulty in inducing general anæsthesia. The patient complained very little of pain during the operation. There were no cerebral symptoms at the moment the ligature was tied, or subsequently. The wound healed by first intention.

A slow but positive improvement followed the operation, as was shown best by the diminished frequency of the hæmorrhages from the nose, marked relief from pain in the head, and general comfort of the patient. The mass diminished perceptibly in size.

On September 24 it was noted that the hæmorrhages and the pains in the head were recurring. Ligation of the left external carotid was now considered and suggested to the patient, who readily agreed to it.

On September 29 the writer operated under cocaine with this object in view. The incision was made along the anterior margin of the sternomastoid muscle, from the angle of the jaw, about three inches downward. This was deepened until the digastric and stylohyoid muscles came into view. The internal jugular vein and common carotid artery were exposed, and followed upward from the upper border of the thyroid cartilage to well above the angle of the jaw. The artery gave off no branches in any direction, the search being made particularly in the submaxillary region. Finally, on working upward under the jaw, a group of vessels could be seen, apparently passing from the main artery towards the mouth and chin. These were believed to be the lingual or facial vessels or both. Because the patient

was under a local anæsthetic, and was showing symptoms of shock, although he had lost little blood, it was considered unwise to search further for the external carotid. It was now necessary to decide between closing the wound and placing a ligature on the common trunk. As the character of the tumor and its situation placed any other hope of relief out of the question, it was decided to tie that vessel. By the following morning the patient had passed into a condition of coma; the muscles of the back were rigid; the hands twitched, and the breathing was stertorous. He died later in the day.

The points of interest in this case are:

1. The presence of a malignant growth, which was so situated that radical removal was impossible, but which caused so much distress that some relief was urgently called for.

2. The impossibility of administering a general anæsthetic which had been demonstrated by previous attempts, and the successful and satisfactory ligation under local anæsthesia.

3. The temporary improvement which followed and was apparent to the patient and all those who saw him, in spite of the advanced stage of the disease at the time the operation was undertaken.

4. The high division of the common carotid which was demonstrated at the time of the second operation. This point was not observed on the right side, as the common trunk only was sought.

Such a high division of the common carotid is very rare. The writer, who performed the second operation, could not, from a comparatively long experience as a demonstrator of anatomy, recall such an anomaly in the cadaver.

In connection with the report the following facts are of interest:

According to the anatomical text-books of Morris, Gray, and Quain, an abnormally high division of the primitive carotid is more common than a low one. Normally, the bifurcation of the common trunk occurs opposite the upper border of the thyroid cartilage. W. J. Walsham ("Morris's Anatomy") says that the division may take place as high as the hyoid

bone, or even the styloid process (which is above the angle of jaw).

Authorities differ as to the dangers of ligating the only patulous carotid. Early writers, especially Galen, Valsalva, Morgagni, and Van Swieten, concluded, from experimentation on animals, that in these both carotids might be tied without serious results. This in the main was corroborated later by Bichat, Mayer Cooper, Mott, Jobert, and Porta. Sir Astley Cooper and Porta differed as to the comparative importance of the carotid and vertebral arteries. It was believed by Cooper that the carotids supplied the external parts of the head rather than the brain, and that only in the more advanced brains, as in man, did the carotids assume greater importance. Ligation of both carotids, according to Cooper, therefore, would not be followed by the same degree of cerebral disturbance as in man. Porta believed that the vertebrals were of no more importance to the brain than the carotids.

James Miller (*London and Edinburgh Monthly Journal,* 1842) held that, in view of the results of M. Jobert on animals, in the future the surgeon need not hesitate to secure both common carotids by ligature simultaneously, should circumstances imperatively demand it. Wardrop was also much inclined to this view. According to this authority, the blood supply is so abundant after ligature of the carotid that there is not the slightest danger to the parts within or without the cranium, from which the main stream has been diverted, " and no one now entertains the slightest fear for the intellectual and other functions of the brain."

Cheever (*London Medical Gazette,* 1855) believed this view to be both erroneous and dangerous.

Many instances are recorded in which one or both carotids were obliterated in man without destroying the life of the individual. Although in some instances delirium, convulsions, adynamia, phlebitis, thoracic and cerebral troubles have in many cases followed, yet in the aggregate the results have been more fortunate.

Pilz, of Breslau, in 1868, collected 600 cases in which the

common carotid had been tied. In twenty-seven both arteries were ligated. He found that the most common cause of death was cerebral disease. Of 386 cases of single ligature, ninety-six showed cerebral symptoms (about 25 per cent.); over one-half of the ninety-six died.

Of the twenty-seven double ligations, five were fatal. Two deaths occurred from cerebral disturbances, while in another case, in which convulsions took place, death did not result. Three others showed temporary disturbances of vision. In only one case were the two carotids tied simultaneously, the interval between the ligatures being only a few minutes; coma and death resulted. When the two sides were ligated, with some days or weeks intervening, the operation was not more frequently followed by cerebral disturbances than when only one was tied.

G. W. Norris, in 1847, from the records of the Pennsylvania Hospital, collected forty-two cases of ligation of the common carotid. Of these thirteen died. In his opinion, the operation of ligating this artery was too generally looked upon as one of comparatively little danger.

J. E. Erichsen, in his work on surgery ("The Science and Art of Surgery"), reached the following conclusions:

1. Ligature of one carotid artery is followed by cerebral disturbances in more than one-quarter of the cases, above one-half of which are fatal.

2. When the two carotids are ligated with an interval of some days or weeks, the operation is not more frequently followed by cerebral disturbances than when only one is tied.

3. Pathological investigation has shown that if the vessels be gradually and successively obliterated the patient may live, although one carotid and one of the vertebrals have been occluded by disease, and the other carotid ligatured, as in a case related by Rossi.

4. As in a case recorded by Davy, an individual may even live for a considerable time, though both carotids and both vertebrals be occluded, the cerebral circulation being maintained through the medium of the anastomoses of the inferior

and superior thyroids, and the deep cervical with the occipital artery.

5. The reason why more or less extensive obstruction of the arteries leading to the brain, by disease, may, as appears from pathological records, be unattended with cerebral disturbance, while this so frequently follows ligature (as has been pointed out by Pilz), is that in the former case the obstruction is gradual, so that the collateral circulation has time to be established, while in the latter, interruption is sudden.

PENETRATING WOUNDS OF THE CHEST, PERFORATING THE DIAPHRAGM, AND INVOLVING THE ABDOMINAL VISCERA.

CASE OF SUCCESSFUL SPLEEN SUTURE FOR TRAUMATIC HÆMORRHAGE.

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PENETRATING wounds of the thorax, perforating the diaphragm, and involving the abdominal viscera stand in a class by themselves, presenting features which require immediate decision in diagnosis and departures in treatment not generally advocated or practised. They are discussed in the text-books and literature from a diagnostic point of view, and the treatment most generally advocated is conservative, doubtless on account of the uncertainty of positive conclusions as to the organ or organs involved, and as well the greater uncertainty as to operative results.

Penetrating wounds of the chest, above and not involving the diaphragm, are of common occurrence, and are met with almost daily in the wards of the larger hospitals in cities. They form a very important part of the work of the active surgeon, and are eminently important and intricate, from their very necessary vital relations. In diagnosis many of them baffle interpretation. In treatment only the exceptional one bears active interference.

In comparison with the abdomen or brain, the thoracic region is an uncultivated field. Men who are bold in invading other parts of the body, hesitate, palliate, procrastinate, and often withdraw, when confronted with a penetrating wound of the chest, especially when it involves the abdominal viscera. The same hesitancy long controlled operators in dealing with penetrating wounds of the abdomen and organs in the upper

peritoneal space, and even at this time cases are seen of penetrating wounds of both lower chest and abdomen where a proper estimate cannot be made of the extent of the injury to the contained viscera, and they are treated conservatively with uncertain results.

Whether this reluctance is from the teachings of our text-books,—a large majority of which advises against operating in penetrating wounds of the chest,—or whether it is the rarity of cases, and consequent lack of experience in this particular region, is a matter to be determined. The fact is plainly apparent that these almost surely fatal wounds, many of them fairly easy to reach, are abandoned with a sterile dressing, a strapped chest, a dose of morphine, and no investigation as to the possibility of interference.

A penetrating wound of the chest below the sixth intercostal space, in the great majority of cases, should be investigated, not by probe or a finger, for neither can give one accurate information. The probe in such wounds should be discarded; the finger, by the possibility of infection and the admission of air and consequent pneumothorax, is far less accurate than the *resection* of a rib, where by actual observation a positive diagnosis can be made and direct treatment instituted.

In the cases here reported, it would never have been possible to determine the extent of the injury, had not resection of a rib been made.

In wounds below the sixth rib the important questions to be decided at once are: Has the diaphragm been perforated? Have the abdominal viscera been wounded? If it is decided that they have not, by what process of reasoning were the facts determined?

If it is decided that they have been wounded, what organ or organs are involved in the thoracic or abdominal cavities, and to what extent?

These are the intricate problems to be met with almost without hesitation, and on these conclusions depends one's future action.

In any penetrating wound of the thorax, anterior, posterior, or lateral, my experience has been—and that experience is borne out by the cases herein presented—that it is impossible to be accurate in estimating the extent of injury done to the viscera on account of the variable height of the dome of diaphragm, and the presence of the omnipresent omentum, which I found in every instance had temporarily plugged the wound openings in the diaphragm, and for the time masked the symptoms. In the cases referred to here there were penetrating wounds of the thorax through the diaphragm with serious involvement of the abdominal viscera.

American authors are strictly conservative in the management of wounds of the chest with or without abdominal complications. Senn, in his most recent work, written after his large experience in the Spanish-American War, says, "We have made but little progress in the treatment of penetrating wounds of the chest."

Direct operative treatment of visceral wounds of the heart and lungs is always attended by imminent risk to life from pulmonary collapse. This source of danger stands in the way of direct treatment of visceral wounds of the chest. Free incision of the chest wall has been strongly advocated by several French surgeons, in cases of penetrating gunshot wounds of the chest, with a view of arresting hæmorrhage by ligation, tamponage, or the use of cautery; but the profession as a whole, for good reasons, is opposed to such heroic treatment. Unless the source of hæmorrhage is one of the intercostals or internal mammary arteries, it is advisable to rely on Nature's resources, aided by such means as will favor thrombus formation in arresting the bleeding. As to treatment, he says further, "From what has been said, it is clear that the best treatment in penetrating wounds of the chest consists in hermetically sealing the wound of entrance and exit, if the latter exists, under strict aseptic precautions, immobilization of the chest by bandaging and rest, and in watching for and treating subsequent complications as they arise."

Thirty-three standard works on surgery—twelve English,

twenty-one American—express the same conservatism in the treatment of chest wounds, and as a matter of assumption include those of the diaphragm and abdominal viscera. Scant reference is made to this complication in any of them.

On the other hand, French and Italian surgeons advise and practise immediate interference in penetrating wounds of the chest, in wounds below the sixth intercostal space, and in heart and visceral wounds not immediately fatal, but not in gunshot wounds passing clear the body.

The recent and valuable work of Lejars on "Emergency Surgery" fixes clearly the practice in France in penetrating wounds of the chest involving or not involving adjacent viscera.

French and Italian surgeons investigate and operate in indicated cases, and their results show the wisdom of their practice.

There is one practical point, so very vital in the management of chest wounds with abdominal complications, upon which some stress should be laid. An American authority of note advises and recommends, in operating on chest wounds where the diaphragm has been perforated, that a thorough examination of the abdominal contents be made by enlarging the opening in the diaphragm. This, I think, is highly impracticable, and while it can be done it is not satisfactory.

This manœuvre I have tried in two of my cases, and in each instance it gave me limited information, and proved a detriment to the patient, on account of the necessity of enlarging the opening in the diaphragm. It is as indefinite and as unsatisfactory as it would be to determine a lesion of the abdominal viscera with a finger inserted through a small wound of the parietes.

My first operative case was done in 1891, for a stab wound through the sixth left costal cartilage, cutting the internal mammary arteries, pericardium, and heart. In this case, through a trap from the sternum, costal cartilages, and ribs, a radical operation was done, and the patient was alive five years afterwards.

In twenty-six cases of complicated wounds of the chest involving the diaphragm, the first ten, except one heart case, died from non-interference, of the remaining number two died within three hours of hæmorrhage, one from a perforating wound of the heart, one from embolism, and three from sequential infection. Of the remaining thirteen, one died one year after operation, and two after a lapse of eighteen and twenty months, respectively. The others are living. The remaining seven were operated upon after the manner to be detailed in this paper. From this experience, I am convinced that a large proportion of the cases of penetrating wounds of the chest should be followed out to the end of the wound, just as are abdominal penetrating wounds, and treated surgically.

In gunshot wounds of the chest where the ball has passed clear through the body, or into the body without causing an early fatal issue, the best practice is not to probe, but to clean the opening or openings and seal. This is the practice laid down by the most advanced workers in military surgery, and is a safe rule to follow. But there are exceptions to this practice, exceptions based on fundamental findings, often to be found if looked for, and one of which will be cited.

It is not my purpose to discuss military surgery or gunshot wounds of the chest, but as one of the cases to be referred to is a complicated case of gunshot wound of the chest, and one which I think would have surely died had he not been subjected to operation, I feel that it is a case directly in point, and one so exceptional that it will prove of more than ordinary interest in the study of penetrating wounds of this character.

These cases have been selected from my work with special reference to the illustration of the different types of chest wound complications.

The first is a gunshot wound, the ball striking the eighth rib, perforating the diaphragm, bisecting the left kidney from pole to pole, cutting the ureter and trunk of the renal artery, and lodging in the erector spinæ muscles.

Gus D., Irish, aged twenty-four years, was admitted to

Provident Hospital, July 29, 1902, 10 P.M. Shot in the left side whole stooping over.

Examination on Entrance.—Temperature, 97° F.; pulse, 88, small and compressible. Skin pale and cold, with profuse diaphoresis, marked dyspnœa, and apnœa. Complained of pain on inspiration over the left side of the chest. Blood oozing from wound in eighth intercostal space, two and one-half inches anterior to the left midaxillary line. Vomited frequently until anæsthetized. Heart, pericardium, and large vessels negative as far as could be learned. Dulness below third intercostal space. There were no indications of injury to the diaphragm or abdominal viscera, and from the fact that he had been shot through the eighth interspace would almost exclude abdominal complications. Balls do not turn corners unless they come into contact with some hard substance. The ball had passed through the eighth interspace, and it was fair to conclude that its course would vary but little from a straight line.

The omentum had plugged the wound in the diaphragm, and the abdominal and pleural spaces were temporarily normally separated.

Following the practice of examining the urine of all emergency patients while on the table, it was found that the bladder contained twelve ounces of bloody urine. This directed attention to the kidneys and abdomen. Examination of the abdomen showed muscular rigidity on the left side and absolute flatness from the twelfth rib into the flank, and the absence of abdominal respiration, a very important sign in men of a peritoneal lesion. The bladder was washed out, and a second catheterization made, and blood found again. As only one ball had entered the body, it was concluded that the abdominal viscera had been injured through the wound in the eighth interspace, and operation was indicated.

Operation.—Incision followed the angle of the eighth rib, five inches long; tissues raised and retracted, subperiosteal resection of about three inches of the seventh and eighth ribs. This gave ample space to reach any part of the diaphragm.

The wound in the diaphragm was treated by a purse-string suture of silk, after the manner suggested by Senn in perforating wounds of the stomach. Over this a continuous Lembert suture.

The pleural cavity was irrigated with salt solution. Wound closed, and the air aspirated with a Davidson syringe.

At this point the treatment of traumatic pneumothorax forces itself into prominence as a factor in estimating the result of the case in hand. In some cases the symptoms from this condition are grave, in others mild. The aspiration of the air from the cavity and a good firm strapping of the chest with plaster have eventuated in all of my cases in success.

Following out the investigation of the perforating wound in the diaphragm, an incision seven inches long was made to the left of the median abdominal line. The intestines and organs were examined with negative results, excepting a bullet wound in the upper inner surface of the kidney. This was closed with continuous suture of catgut, with the idea of protecting the peritoneum from infection incident to any procedure on the bleeding kidney.

An oblique incision was made in the left loin for the purpose of investigating the kidney. When the lumbar fascia was reached, it was found bulging into the wound, and the space dark with extravasated blood. On incising the lumbar fascia, there was an escape of dark clots, followed immediately by profuse arterial hæmorrhage. Temporary deep pressure by tampon controlled the hæmorrhage until the kidney was separated from its surrounding fat, and followed down to the ureter, which, with a large trunk of the renal artery, was found to have been cut by the ball. The kidney was removed. He made a slow but perfect recovery, and remains active and well more than a year after.

The second case is a stab wound of the chest through the eighth interspace and diaphragm and into the spleen. This case adds one more to the very few cases recorded of successful suture of the spleen for traumatic hæmorrhage.

Patient, Alfred C., aged twenty-seven years, was admitted to Provident Hospital, July 30, 1902. Discharged, well, August 30, 1902. Was asked to see and operate upon him by Dr. A. W. Williams.

Examination on Admission.—Temperature, 98° F.; pulse, 92, good quality. Complained of pain in and about the wound and in the left abdomen. Short, shrill, hacking cough. Unable

to lie down. Extreme dyspnœa, due to pulmonary collapse. Slight cyanosis. No hæmorrhage from wound on account of valve action of its margins. Heart normal. Dulness over the left abdomen. Slight muscular rigidity. No positive signs of hæmorrhage into the abdomen.

At this examination there were no indications for immediate operation. This is one of that class of cases usually treated on the expectant plan, and always results in death.

From this case, which proved the most interesting and instructive that I have ever met, many useful lessons have come.

After watching the patient for an hour, I concluded to operate on the progressively urgent indications. The pulse had increased from 92 to 140, with lessened tension. There was profuse diaphoresis, increased dulness in the left abdomen, with extreme muscular rigidity, and a leucocytosis of 30,000, his symptoms all pointing to active hæmorrhage.

Operation.—Incision following the angle of the eighth rib, retracted over the ninth; resection and method the same as in first case. The wound in the diaphragm was one inch in length, and firmly plugged with omentum; this was reduced by clamping with a pair of forceps, and carried into the abdomen. Wound in the diaphragm was closed, also the costal resection. The skin incision was extended downward over the left lateral abdominal wall into the cavity of the abdomen, which was found full of clots and free arterial blood.

Slight traction on the gastrosplenic omentum enabled me to deliver the spleen on to the abdominal wall for examination. It bled profusely from an incised wound extending from the phrenic to the lower part of the organ. To control the hæmorrhage, a turn of gauze with a drawn loop was put about the pedicle. Here I was confronted with a bleeding spleen. How should it be treated?

My first attempt at suture ended in complete failure by tearing out as I endeavored to draw the suture down. I therefore changed my method by selecting a full, curved, round Mayo needle threaded with No. 2 catgut. This I introduced one-half inch from the margin of the wound edges, and without the least force allowed the needle to follow its full curve, emerging from the opposite side of the wound the same distance as it entered, and making a triple loop without a reënforcing knot. Hot gauze

compresses were held on each loop as the edges were approximated, with the idea of causing the catgut to swell and engage opposing fibres, so as to make a firm line. Every suture put in in this manner held firmly.

After watching it for twenty minutes, I returned the spleen to the abdomen, and surrounded it with omentum, a very important part of the detail, on account of its well-known property of protection. The patient made a rapid and permanent recovery. He left the hospital in three weeks. (Fig. 1.)

This case was operated upon in July, 1902, From that time until October, 1903, I had been unable to find a case of successful spleen suture in literature. In November, 1903, Senn's article appeared, and gave the index number of Berger's article and a vast amount of valuable information on this subject. From this reference I have been able to see the original article of Berger's.

Suture of the spleen was first performed by Lamarchia in 1896; his patient died from secondary hæmorrhage. Madelung, in the year following, operated upon a similar case with recovery. Berger's article reports fourteen cases of splenorrhaphy, with two deaths, and ten cases treated by tampon with one death. Adding my case, we have fifteen cases with but two deaths. This destroys the theory that suture of the spleen for traumatic hæmorrhage is impracticable. Ten cases of tamponade with one death give a choice of two methods of treatment, from which 75 per cent. have recovered. For a method of treatment that had been rejected, abandoned, and discouraged, this is a most excellent showing, and will go a long way in impressing those who may have been sceptical that suture and tampon are the methods of choice for traumatic hæmorrhage of the spleen.

From my very limited experience, I firmly believe that it is the method of the application of the suture, and not the suture *per se,* that has caused the failures. To apply suture to a bleeding spleen as one would to almost any other tissue in the body will certainly eventuate in failure. It requires method, technique, and a proper adjustment of the omentum

in the completion of the operation to have a successful result.

As far as I have been able to learn from the Indexes of the Newberry Library, and the Library of the Surgeon-General's Office in Washington, this is the only successful case of suture of the spleen for traumatic hæmorrhage reported in this country, except the one reported by Tiffany, of Baltimore, in 1894.

The cases abroad are multiplying, and successes are becoming more frequent as technique and method improve.

In the management of traumatic hæmorrhage of the spleen, there are other methods of treatment which are strongly advocated, such as tamponade, cauterization, and forcipressure. Each of these several methods has its strong advocates, and perhaps may be of equal value in efficiency in the final result, but, as the cases are exceedingly rare, it will be a long time before any surgeon will be able to demonstrate the perfection of any special line of treatment, although it now looks as if suture and tampon were the methods of choice.

The third case is added to show the variance of penetrating wounds of the chest. This special type of penetrating wounds below the fifth interspace on either side should impress itself as a most formidable and usually fatal injury. They are wounds that it is positively impossible to diagnose without an exploratory incision until perhaps it is too late. And an exploratory incision here is just as necessary as it would be in a stab wound of the abdomen.

J. P., aged thirty years, referred to me by Dr. A. B. Schutz, stabbed July 30, 1903, through the sixth interspace, one inch anterior to the nipple line. Temperature, 97° F.; pulse, 110, fairly full and regular; respiration, 40; skin cold and clammy. Heart and lungs negative, except below the sixth rib, from which dulness extended downward to the tenth rib. Abdomen negative, arterial blood escaping from the intercostal vessels. As we could get no reliable history of the extent of the wound, exploratory operation was decided upon. Incision four inches long, following



FIG. 1.—Spleen suture; showing line of incision from chest over abdomen to give ample operative field for thorax, diaphragm, and abdomen.



FIG. 2.—Stab wound through thorax, diaphragm, pericardium, and colon. Showing chest and abdominal incisions.

the curve of the sixth rib, retraction of tissues, and subperiosteal resection as described in case one.

On opening the pleural cavity, the patient was dangerously cyanosed on account of the pulmonary collapse, and inability of the right heart to accommodate itself to the emergency.

Two perforating wounds of the diaphragm, one on the outer or pleural side near the dome, and one in a direct line on the inner or pericardial side, were found. Also an irregular wound of the pericardium. No injury to the heart. The diaphragmatic wounds were treated with purse-string silk suture, over this a continuous Lembert. The opening in the pericardium was united with fine silk, the pleural cavity irrigated, and the costal opening closed. I continued the incision below the diaphragm, and carefully explored the abdomen, finding a punctured wound of the transverse colon. This is the only safe practice following penetrating wounds of the diaphragm.

The findings in this case, without symptoms special to any organ or viscera within stabbing distance of the walls of the thorax, again impresses one with the necessity of investigating selected cases of penetrating wounds of the thorax. Had not this case been early operated upon, it is fair to presume that the patient would have died. He recovered. (Fig. 2.)

OPERATIVE TREATMENT OF PERFORATING GASTRIC ULCER.

REPORT OF A THIRD CONSECUTIVE SUCCESSFUL CASE OF SUTURE.

BY A. B. ATHERTON, M.D.,

OF FREDERICTON, NEW BRUNSWICK, CANADA.

On September 19, 1894, I operated for the first time to close a perforation due to gastric ulcer. This was, I believe, the first successful case of the kind on this continent, and is so admitted in a paper read by Dr. Finney, of Baltimore, in 1900, before the Association of American Surgeons.

On March 29, 1899, I did a second operation, which also resulted successfully. Both these cases were reported in the *New York Medical Record.* The first patient was operated on fifteen hours after perforation; the second one in ten hours, and the one about to be reported in three and a half hours.

The first case occurred in a young anæmic female servant; the second in a man of over sixty years of age, who had suffered for many years from dyspeptic symptoms.

Report of Third Case.—On September 5, 1903, I was called by Dr. W. H. Irvine to see with him a man, thirty years old, who had dropped down on the street from a sudden agonizing pain in the abdomen. He had been troubled for some years with symptoms of indigestion, and two or three years ago gave up teaching school and took up manual work because it seemed to agree better with him. He had never vomited blood at any time. A few days ago he began to have attacks of quite severe pain with flatulence, coming on about three hours after meals. He, however, made little or no change in his food, and at noon to-day ate a hearty meal. At 5 P.M. he treated himself to some pears, and immediately afterwards was seized with the excruciating pain in epigastric region above mentioned. Dr. Irvine was at once sum-

moned, and gave him three-quarters of a grain of morphine in two doses. In spite of this the pain continued very severe, and about 6.30 P.M. I was sent for by the Doctor, who began to suspect a perforated gastric ulcer.

I found a fairly healthy looking man evidently suffering a good deal and doubled over forward from the abdominal pain. The belly-wall felt extremely hard and rigid, especially at its upper part. It was also tender on pressure here. No manifest distention present, and no loss of liver dulness.

I agreed with Dr. Irvine's diagnosis, and we had the patient at once removed to the hospital and prepared for operation.

The operation was begun at 8.30 P.M., Dr. McGrath giving the anæsthestic, and Dr. Irvine assisting me. An incision made from the ensiform cartilage to near the navel. A few bubbles of gas escaped on opening the peritoneum. Stomach somewhat distended, and its pyloric end was covered in places with lymph. There was now also seen an opening of about the size of a crow's quill on the anterior wall just at the narrowest part of the pylorus, from which flowed mucus and a chocolate-colored semi-solid matter. I closed the perforation by two rows of silk sutures, the inner one including all the coats and the outer being a Lembert. The adjoining parts were then cleansed with gauze pads, and the abdominal wound united with through-and-through silk-worm-gut sutures. The usual antiseptic dressings, with adhesive straps and bandage.

September 6, 9 A.M. Slept six hours. No vomiting since operation. Pulse, 76; temperature, 100° F. Just before operation, the pulse was 100 and temperature 99° F. At 9 P.M. his pulse was 70 and temperature 98.8° F. During the day was troubled with gas, and a turpentine enema was given, which resulted in a fair stool and got away a good deal of the gas.

September 7. Slept well; pulse, 70; temperature, 98° F.

September 8. Doing well. Pulse and temperature normal. Wound dressed. It looks all right.

September 16. Has gone on perfectly well. Sutures all out to-day. Has an egg and some toast and junket every day now.

September 23. Doing well. Ate a banana five days ago without anybody's consent; was none the worse for it, apparently.

September 26. Left hospital, being the twenty-first day after operation.

Remarks.—The main element in securing a favorable result in operations for perforated gastric ulcer is unquestionably an early diagnosis and a prompt resort to surgical treatment. The chief reliance, we think, should be placed on the location and severity of the pain, together with the board-like hardness of the abdominal muscles, in determining the diagnosis. Considerable help is afforded in most cases by the previous history of dyspeptic symptoms. Not much dependence can be placed on the absence or otherwise of liver dulness. Only once in some half-dozen of these cases have I noticed so much tympanites as to obscure the normal percussion sound over that organ. Neither can we derive much help from observing the presence or absence of shock. Usually, more or less will be met with at the outset, but this is not always the case. Some vomiting commonly occurs, and at times a little blood is found in the vomited matter.

A NEW OPERATION FOR INTESTINAL STENOSES.

BY THEODORE A. McGRAW, M.D.,

OF DETROIT, MICHIGAN,

Professor of Surgery in the Detroit College of Medicine.

It has been the experience of all surgeons that resections of the colon are followed by a high rate of mortality. Wölfler, in a paper read before the German Surgical Society in 1896, stated that 54 per cent. of such operations on the large and small intestines resulted in death. Körte, in nineteen cases of colonic resection for cancer, had seven deaths; but as six of the nineteen cases were in the ileocæcal region, and as all of the six recovered, there remained thirteen cases involving other portions of the colon with a mortality of nearly 54 per cent. The fatality rate differs, therefore, with the location of the disease. The greatest success has been attained in the ileocæcal region, and next to that with the sigmoid, while radical procedures on the transverse colon and the colonic flexures have been exceedingly disastrous.

The success attained in the ileocæcal region has probably been due, in large part, to the ability to isolate that part of the gut and to protect the abdominal cavity from infection. It may be, too, that the intestinal contents, which in case of obstruction in that region accumulate in the ileum, are less virulent than those which collect in the colon when the obstruction is farther down. However that may be, a careful study of these operations leaves little doubt that the greatest danger is the exposure of the abdominal cavity to infection from the cut bowel. Besides this, the causes of the high rate of mortality are to be found in the general condition of many of these patients when they are operated upon, the diseased condition of the gut above the seat of obstruction, the changes which take place in the intestinal contents from long retention and

from their mixture with secretions from the congested mucous membrane, and from the attempt to make end-to-end anastomoses in bowels differing enormously in size. Many of these operations, too, have to be made at a time when the partial chronic obstruction has become complete, when the patient has become exhausted by a long, painful struggle, and when the bowels have become acutely congested and inflamed.

The operation becomes then urgent, and the surgeon may hardly allow himself time for a thorough examination of the case, and cannot delay action until he has brought the patient into a better condition. Under such circumstances operations are done at a great disadvantage, and many patients die who might have been saved if operated on at an earlier period. If the bowel is resected, when the abdomen is open the greatest difficulty is experienced in preventing infection. The whole intestine, except that part below the seat of stenosis, is full of long retained fæces, which have acquired a highly virulent quality. To empty the gut requires a long time, during which the intestines are more or less exposed. If an end-to-end junction of the cut bowel is attempted, the surgeon is puzzled by the difference in caliber and in quality of the two ends, for the proximal end is dilated often to a diameter of three or five inches and has walls which are knobby and parchment-like, while the distal end is contracted to half of the normal size and is soft and pliable.

The German surgeons have sought in various ways to overcome these difficulties. Mikulicz was the first to abandon the "one time" operation and to resort to a method of operating in which the gut in one operation was fastened outside of the abdominal cavity, in a second resected, and in a third repaired. His method is as follows:

First of all, the abdomen is opened and the diseased area freed from its attachments and stripped of its blood-vessels.

The mesenteric glands are removed and the rents in the mesentery repaired.

The two limbs of the affected coil are then brought parallel to each other and fastened together with Lembert stitches. The

tumor and three or four inches of the intestine are next brought out of the wound and the abdomen closed snugly around them. The parts to be removed having been deprived of their blood-vessels mortify, and in two or three days are ready for removal and are cut off. A glass tube inserted into the afferent branch carries off the fæcal discharge. Two weeks later, the spur between the two bowels is divided by a clamp, the adhesions formed between the two rendering the operation without danger to the other viscera. Of twelve cases thus treated, ten recovered.

Hochenegg has had success with a similar operation, without, however, resorting to that unnecessary measure of depriving the gut of its blood-vessels, and thus inducing gangrene. He brings the tumor well out of the abdomen, prevents its retraction by passing a fold of iodoform gauze through the mesentery, and closes the abdominal wound around the bowel with sutures. After a few hours he makes a small opening in the distended afferent limb, inserts a glass tube, and empties the intestine. At the end of ten or twelve days the abdomen is reopened, the tumor and adjacent parts of the gut are excised, and the two ends united with circular suture.

The objections to both of these procedures are the multiple operations necessary to their completion.

The deliberate production of gangrene in Mikulicz's procedure seems to me unnecessary and useless, while the cure of a false anus by clamping the spur is tedious and imperfect when it does occur, and often fails to take place even when the spur has been destroyed. In that case the surgeon has to resort again to a laparotomy and to resection of the bowel. Hochenegg's procedure necessitates an opening of the abdomen and a junction of the bowel in an exhausted patient, who has barely recovered from a laparotomy.

That these secondary operations are by no means devoid of danger is proven conclusively by Wölfler's statistics, in which a mortality of 22 per cent. is reported in operations for the cure of false anus.

Stimulated last winter by a fatal case of colonic resection

for cancer, I have given a good deal of study to the technique of these operations. It has seemed to me that the existing methods of procedure might be very much improved, and I venture to bring before the profession a method of operation which, I hope, may prove in practice what it seems to me to promise in theory.

The main and essential things in operations for colonic cancer are:

First. The protection of the abdominal cavity from infection by deferring the evacuation of the intestinal contents until the abdominal wound has been completely closed and hermetically sealed. This can be done only by bringing the tumor out of the abdomen and fastening it there while the gut is opened.

Second. The avoidance of all serious secondary operations which would bring new risk to the patient. I propose to accomplish these objects in the following manner:

Given a tumor or a stenosis of the colon, every effort should be made to locate exactly the seat of disease, as the knowledge of its location enables the surgeon to make the abdominal incision at the most favorable point. For this reason, such cases should be carefully studied beforehand, and never operated on without the most careful investigation. If the tumor can be felt, its location is plain. In the many cases in which it cannot be felt, we may, nevertheless, locate, approximately, the seat of the stenosis by studying the reactions of the afferent and efferent limbs of the bowel.

That contraction of the intestine which is the invariable accompaniment of an obstruction can often in a thin person be seen through the abdominal wall. There is a wave of distention which begins at a distance from and ends at the point of stricture. Careful examination of this wave-like tumor will often show the acute observer in what portion of the abdomen the stenosis is situated. If the stricture does not completely close the gut, the passage of fluids or semifluids and gas through the narrowed portion is announced by a gurgle, which is most distinct over the seat of trouble.

The location, then, of the end of the abdominal wave and

of the loudest gurgle will in many patients enable us to locate the seat of disease.

We may also locate it by watching the effect of a large high enema in the efferent bowel, for, if an enema of water were pumped into the colon in sufficient quantity to dilate it, we should find that the distention would occupy only that portion of the bowel below the stricture. Distention with gas would answer the same purpose. In very fat persons, the phenomena thus caused are not so perceptible, and in some cases complications of any kind might obscure the diagnosis. Indeed, careful and repeated examinations can alone give that surety in such cases which would warrant the surgeon in directing his operation by his diagnosis.

If the tumor can be even approximately located, the abdomen should be opened directly over it. If that is impossible, the exploratory incision should be made in the median line. The tumor or stricture having been found, the coil in which it is seated should be drawn out of the abdomen, and, if necessary for this purpose, adhesions should be broken or cut, enlarged mesenteric glands should be then removed, and the mesentery repaired. At this stage, the two limbs of the intestine leading to and from the tumor, at a sufficient distance from the seat of disease, should be joined together by Lembert sutures and an anastomosis made with an elastic ligature. If the exploratory opening in the abdomen should seem best adapted for the purpose, the wound should now be closed snugly around the protruding coil, the ligatured portion remaining in the abdominal cavity, and the tumor, with a length of gut of two or three inches, outside of the abdomen. If the exploratory incision is made in the median line and the tumor is found to exist at either angle of the colon, it would be better to close the median incision and make a new one over the tumor, just large enough to permit of its easy exit. In every case the tumor should be drawn out of the abdomen at that point which would most nearly permit the resected intestine to occupy its normal position. (Fig. 1.)

When the wound has been closed and sutured to the pro-

truding intestine, a firm silk ligature should be tied around the efferent limb just below the tumor and the gut cut off below it, care being taken that not the least portion of its contents is allowed to come in contact with the wound. This part of the

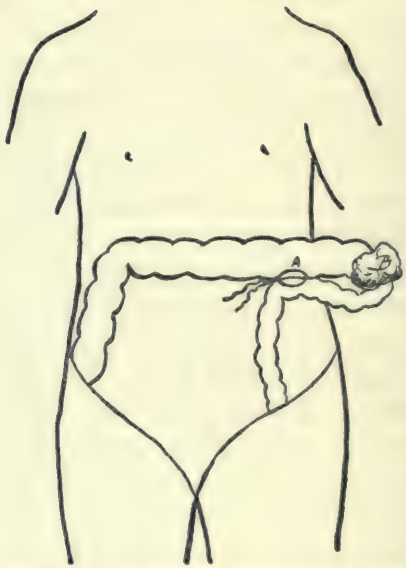


FIG. 1.—Cancer of colon at splenic flexure. *A*. Anastomosis made by elastic ligature between the afferent and efferent limbs of the colon. *B*. The cancer, which has been drawn out of the abdomen through a lateral incision.

gut is small, contains little fæces, and is easily cleansed and disinfected. It may now be closed with a circular suture, inverted into itself, and pushed in until its outer surface no longer projects beyond the level of the skin. (Fig. 2.) A few Lembert sutures will now hold it in position and the integument may be brought over it and sutured. In this way the efferent limb is, once and for all, disposed of.

When the gut is divided just below the ligature, the afferent distended portion should be seized by an attendant and wrapped in gauze. As soon as the efferent limb has been hidden under the integument, the surgeon should examine carefully the sutured line which fastens the proximal bowel to the integument, and see that the abdomen is thoroughly closed.

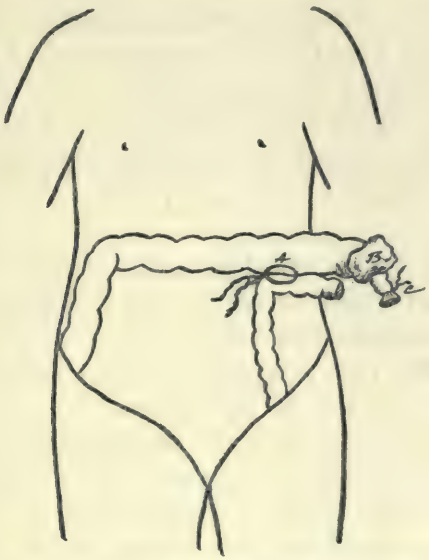


FIG. 2.—A ligature has been tied around the efferent limb at *c*, and the bowel divided below it

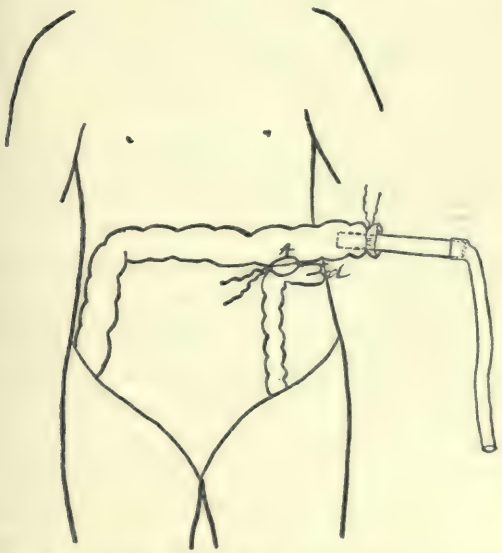


FIG. 3.—The divided end of the efferent limb has been inverted at *d* and the skin sutured over it. The cancer has been removed, and a glass tube inserted into the proximal end of the colon for the evacuation of fæces.

Layers of gauze soaked in collodium should then be placed over the whole wound so as to seal it hermetically. A large trocar, such as has been used for the discharge of fluids from ovarian cysts, in operations for the removal of those tumors, may now be thrust into the intestine and the fæces discharged. A rubber tube attached to the trocar will carry them into a proper receptacle.

When the gut has been thoroughly emptied of fæces, the diseased portion should be cut off and a large glass tube inserted into the bowel and tied in place by an encircling ligature. To this a rubber tube is attached for the disposal of fæces. (Fig. 3.) At the end of four or five days, the fæces will find their way through the new channel of anastomosis and pass into the lower bowel. As soon as this is determined by fæcal discharges per rectum, the tube may be removed, the gut sutured and turned into itself, and the wound in the integument closed over it. (Fig. 4.) In this way we shall have guarded the abdomen from all contamination from the opened bowel, have excised the diseased portion, and made the anastomosis and completed the work in what is practically but one operation, for the final disposal of the proximal end by inversion and suture can hardly be dignified by the name of operation.

It is evident that the success of this procedure will depend upon the success of the entero-enterostomy with the elastic ligature.

It must be remembered that the great distention of the proximal portion of the colon will tend to force a discharge through the smallest aperture. For this reason the rubber ligature must be passed with the greatest care. I should not trust an ordinary needle for this purpose, because, even though the ligature is put on the stretch, it would offer a shoulder which might unnecessarily enlarge the opening made by the needle.

The McLean needle, which I have used in anastomoses of the bowels, does away with the shoulder made by the doubled rubber thread and permits the use of a ligature much larger than itself. Notwithstanding the slight shoulder caused by its

ferrule, it is an excellent instrument. The Smith needle is absolutely free from all shoulder and answers the purpose admirably. If the large-sized rubber is used with this needle, it can be passed while on the stretch, and will immediately expand beyond the size of the aperture, filling it completely.

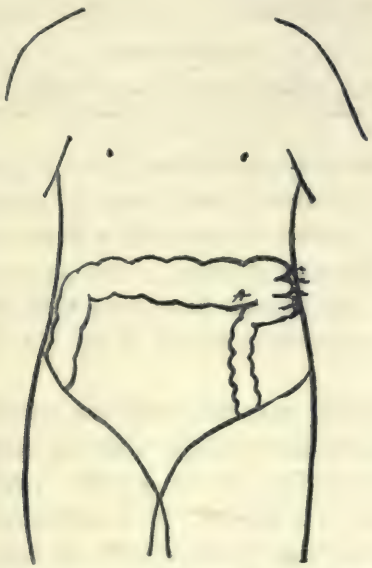


FIG. 4.—The anastomosis at *A* has been completed, and the end of the proximal limb has been inverted. The skin has been sutured over the intestine.

The thickest portions of the large intestine are those occupied by the longitudinal bands, and these should be chosen for the passage of the needle, as the danger of any extravasation would be diminished thereby to the uttermost. This operation may be used on all forms of intestinal stenosis.

PNEUMOCOCCUS PERITONITIS.

A REPORT OF FIVE CASES.

BY FRANK S. MATHEWS, M.D.,

OF NEW YORK,

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DURING the early part of the year 1901 there came under the writer's observation three cases of pneumococcus peritonitis. These formed the basis of a short paper read before the Roosevelt Hospital Alumni. This paper was not printed. Since then two other cases have been seen, all five occurring in the medical or surgical wards of St. Mary's Free Hospital for Children.

During the past year two excellent articles have appeared in German publications dealing with the subject of pneumococcus peritonitis. The one by Jensen (*Archiv für klinische Chirurgie,* 1903, lxx, p. 91), of Copenhagen, gives the histories of 106 cases, and to the article are appended 134 references to literature. The article by von Brüns (*Beiträge zur klinische Chirurgie,* 1903, xxix, p. 57), of Tübingen, was briefly reviewed in the December, 1903, number of this Journal.

In general, these articles are in accord, and many of their statements are borne out by findings in the five cases to be reported. Points to be especially noted in our cases will be presented after the histories of the cases.

In symptoms, course, pathological anatomy, and prognosis, pneumococcus peritonitis differs considerably from other types of peritonitis. A knowledge of these characteristic features of the disease will considerably aid one in making a diagnosis. The following description of the disease is largely borrowed from the articles of Jensen and von Brüns.

Frequency.—It is rare as compared to other pneumococcus infections. Netter, in 104 pneumococcus infections of adults,

found no case of peritonitis, and in forty-seven such infections in children found it once. Moreover, among 140 cases of peritonitis bacteriologically examined he found the pneumococcus but twice. This is the more remarkable when it is added by Netter that in autopsies on pneumococcus pneumonias he was regularly able to demonstrate the pneumococcus in cover-slip preparations from the peritoneum. Flexner and others have confirmed this observation. Jensen records 106 cases of pneumococcus peritonitis. Several observers have seen from five to eight cases each. This would suggest to us that the disease is more frequent than hitherto supposed or than would be indicated by the total of 106 cases.

Age.—It is perhaps three times as frequent in children as in adults.

Sex.—Under fifteen years of age it is seven times as frequent in girls as boys. The two sexes are equally affected in adult life.

Mixed infection is infrequent, but has occurred when the disease has been the result of intestinal processes, as appendicitis and gastric ulcer.

Pathological Anatomy.—To one familiar with pneumococcus empyema very little need be said. There is a very fibrinous exudate without odor, of greenish yellow color. The consistency varies as in empyema; in one case the exudate is practically solid, in another quite fluid, with perhaps large masses of fibrin. One to four litres of pus have been evacuated in reported cases.

Localization.—There is a decided tendency for the process to become localized in the pelvis and hypogastrium, forming there a large, thick-walled abscess. There are other cases in which the process is diffuse, covering every spot of peritoneum with thick fibrinous exudate.

Termination.—A considerable number of cases have been discovered at autopsy; a number have ruptured through the abdominal wall at the umbilicus, one has discharged through the vagina. A large percentage of the incisions for hypogastric abscess have resulted in cures.

Associated Lesions.—Among these the most frequently observed are empyema, pneumonia, pericarditis, otitis media, and intestinal lesions. Salpingitis has been noted a few times in adults. In the majority of cases reported the peritonitis has appeared primary. There has been no history of pneumonia, nor has pneumonia, as a rule, been present at autopsy. In a few cases a pneumonia has followed the peritonitis.

Symptoms.—The most characteristic clinical picture is seen in the apparently primary cases, and three stages may readily be distinguished:

1. Sudden onset with high fever, vomiting for a day or two, tenderness and distention. There is little muscular rigidity, and the pain and distention are not so marked as in the other types of peritonitis.

2. After a few days vomiting ceases, temperature falls often to normal. Diarrhœa, often present in the first stage of the disease, is the rule in the second stage. The amelioration of symptoms is pronounced, appetite returns, and the child looks better.

3. Then with the increase of exudate there appears a tense cystic mass in the hypogastrium, temperature rises, and shows marked morning and evening remissions and exacerbations. There is cachexia and weakness, and the case terminates in from one to four months in death from exhaustion or in recovery following operation or perforation at the umbilicus.

Prognosis.—This is one of the less virulent types of peritonitis, since there is such a pronounced tendency to the localization of the process by the abundant fibrinous exudate thus forming one or more abscesses. As already mentioned, there are two types of the disease,—the diffuse, which may be expected to result fatally unless future experience shows that cases can be headed off by early operation, and the localized, which usually results fatally, unless operation is undertaken.

But when the localized form is operated upon, 80 per cent. of cases may be expected to recover. This high percentage of recovery has been obtained in cases operated upon

from seventeen days to four months from the beginning of illness and in presence of one to four litres of pus.

Differential Diagnosis.—The late stages of the disease simulate tubercular peritonitis. In the second stage with diarrhœa and slight distention the picture is not unlike that of typhoid. In the early stage one may question whether a peritonitis exists at all, since distention and pain are not necessarily marked, and the bowels move readily with cathartics. The question of peritonitis secondary to appendicitis will arise, and in some cases the appendix has been the source of infection. The acute stage passing into one of falling temperature with localization of symptoms in the pelvis may simulate gonorrhœal peritonitis.

Etiology.—Following Jensen, we may recognize the following methods of infection:

1. Through a wound. One such case is reported following a hernia operation.

2. Through the diaphragm. This may be either an actual extension of inflammation from the thorax through the tissues of the diaphragm or a transportation of bacteria by the lymphatics from the thorax to the abdomen. This can undoubtedly occur, even though it involves a retrograde transportation, that is, a turning about of the usual lymph current, which is from peritoneum to thorax.

3. Through the genitals. The greater frequency of the affection in girls naturally has suggested the genitals as a portal of entry. However, there is no other proof of it than this single fact. Further, pneumococcus tubal infections are very rare, and have only been observed in adults. Moreover, in adult life males are as often affected as females. We must admit that there is at present no satisfactory explanation of the much greater frequency of the disease in girls.

4. Through the intestinal tract. Flexner was the first to report a pneumococcus peritonitis secondary to intestinal ulceration. It has also followed ulcer of the stomach.

5. Through the blood. Pneumococci are often found in the blood in pneumonia, and from this source bone and joint

infection may occur. In the same way in a pneumococcus septicæmia peritonitis may appear as a terminal inflammation.

6. From pneumococcic foci in the abdominal organs.

The depositing of the cocci in the peritoneum is not alone enough, however, to cause the peritonitis, as is shown by the frequent presence of the germs in cases of pneumonia in the peritoneum without a peritonitis. Some predisposing factor must be assumed.

CASE I.—*Empyema, Meningitis (?), Peritonitis, no Pneumonia.*

E. B., aged three years, female. Patient has been sick several days. Symptoms same as those on admission, *i.e.*, fever, extreme restlessness, abdominal pain, and constipation. There was moderate distention of abdomen and right thigh was slightly flexed. The mental condition was striking; the child would lie still for a few moments with eyes closed, but the slightest touch upon the skin, as, for instance, to feel pulse, would cause her to cry out and pull away her hand. The abdomen, though distended, was not more sensitive to touch than other parts of the body, and the distention was largely relieved by enema. The forepart of the chest, which alone was examined, revealed nothing. The diagnosis seemed to lie between peritonitis of unknown origin and meningitis. After admission, the bowels moved well as the result of an enema. Though there were no focal symptoms of meningitis, the peculiar cry and hyperæsthesia were suggestive of it. She was kept under observation twenty-four hours, and then, though diagnosis was no clearer, it was thought better to explore the abdomen. Accordingly, under ether, the writer made a one and one-half inch abdominal incision. Coils of intestine were distended and of a bluish color, but there was neither pus, fibrin, nor fluid of any kind in the abdomen. The wound was closed. Patient rapidly recovered from ether, and shortly afterwards began to emit short, sharp cries at intervals. Temperature ranged from 101.5° to 103.5° F. For two days following operation there was drowsiness, at times restlessness. She took fluids well and never vomited. She died two and a half days after exploration.

Autopsy revealed small empyema behind lower part of left

lung; there was not more than an ounce of pus. Hypostatic congestion, but no consolidation of lungs. There was a peritonitis of the hypogastric region and pelvis; stomach and liver not involved. There was little fluid anywhere, but intestines were glued together by a yellow fibrinopurulent material. The wound showed no gross evidence of infection.

Diplococci with capsules were stained in pleural and peritoneal pus. Cultures were made on Loeffler's serum, and gave an abundant growth of diplococci apparently in pure culture.

CASE II.—*Empyema, Peritonitis, no Pneumonia.*

W. S., aged two and one-half years, male. Admitted to hospital October 5, 1901. The illness, which has extended over eight weeks, has been characterized by chills, fever, and cough. Pneumonia of right lung diagnosed before admission. Temperature on October 6, 101° F.

October 7 transferred to Dr. Charles N. Dowd's service. Portion of eighth rib on right side resected by Dr. Munger, the House Surgeon. Sixteen ounces of pus evacuated. Temperature normal for next three succeeding days; from the fourth to seventh day after operation it ranged from 99° to 104° F. Abdominal distention gradually appeared, and there was vomiting during the last twenty-four hours of life. Patient died seven days after operation.

Autopsy showed no pneumonia. Right lung adherent to chest wall in front and behind. Empyema cavity extends from apex of lung to diaphragm. There was no retention of pus. Diaphragm intact. The abdominal cavity contained thick yellow pus not uniformly distributed, but found chiefly along ascending colon, under surface of liver and in pelvis. Microscopical examination of thoracic and peritoneal pus by Welch's method of staining revealed the pneumococcus.

Dr. Dowd states that in this case during life the child showed great prostration and the large abdomen of rickets, yet there was no tense abdominal distention, severe pain, or flexion of the thighs.

CASE III.—*Empyema, Suppurative Pericarditis, Peritonitis, Pneumonia.*

J. R., aged three years, male. Admitted to hospital service of Dr. Swift May 2, and died May 5, 1901. Illness of two weeks' duration. Temperature on admission, 102° F. There was pallor,

abdominal distention and flatness over posterior part of right chest. Bronchial voice and breathing over both lungs.

Temperature ranged from 102° to 105° F., and patient died in convulsions.

Autopsy showed two ounces of pus in right chest, lower part of left lung adherent and consolidated.

Three ounces of thick yellow pus in the pericardium.

There was a general peritonitis with moderate amount of fluid. The process was most marked on the upper surface of the liver. Coils of gut adherent. Pelvis contained straw-colored fluid. Pneumococci found in pleural and peritoneal pus, not sought in pericardial pus.

Dr. Dowd recorded that before death the child gave no evidence of peritonitis except pain. He frequently put his hand to the abdomen. Bowels moved regularly, abdomen was soft, and not so tender that touch elicited marked pain.

CASE IV.—*Empyema, Diffuse Peritonitis, no Pneumonia.*

M. D., aged five years, female. Admitted to hospital, June 3, 1903, with physical signs of empyema of right chest.

June 4. Operation by House Surgeon, Dr. Lewis. Portion of rib removed and a pint of pus evacuated.

June 6. Vomiting.

June 7. Rise of temperature, abdomen distended and tender. Enema effectual.

June 9. Temperature normal.

June 14. Abdomen is less tense, but there is still tenderness on palpation. The bowels are loose.

June 15. Died.

Autopsy.—Abdomen not distended. All abdominal viscera covered with and agglutinated by a thick, greenish yellow, nearly solid exudate. The only portion of peritoneum not thus covered was the upper surface of the left lobe of the liver. The lining of the empyema cavity gangrenous. Cavity perfectly drained. Lungs show slight hypostatic congestion. The muscular tissue of the diaphragm appears not involved, although peritoneum below and pleura above it are.

CASE V.—*Pneumonia, Peritonitis.*

J. K., aged three years, male. Admitted April 25, 1904, to the service of Dr. Swift. The child has been sick for two weeks

with cough, fever, pain in the abdomen, and nose-bleed. Child is anæmic. Examination of chest and abdomen negative.

May 1. Marked dyspnœa and restlessness. Dulness over middle and lower lobe of right lung. Pain in the abdomen, vomiting, and constipation. Bowels moved with enema. Abdomen tender.

May 2. Urine contained abundance of albumen, granular and hyaline casts.

May 3. Leucocyte count, 40,000.

May 5. Died.

Autopsy.—Left lung shows slight hypostatic pneumonia. Nearly the whole of the right lung is covered with yellowish fibrin. There is a gray hepatization of the greater part of the middle lobe and a red hepatization of part of the lower lobe. Right heart enormously distended.

Peritoneum through most of the abdomen shows no change. The true pelvis is filled with rather thin fibrinous exudate. Fibrinous exudate also surrounds the caput coli and lower part of descending colon. No peritonitis around stomach, liver, or diaphragm. Colon empty and contracted, small intestine moderately distended.

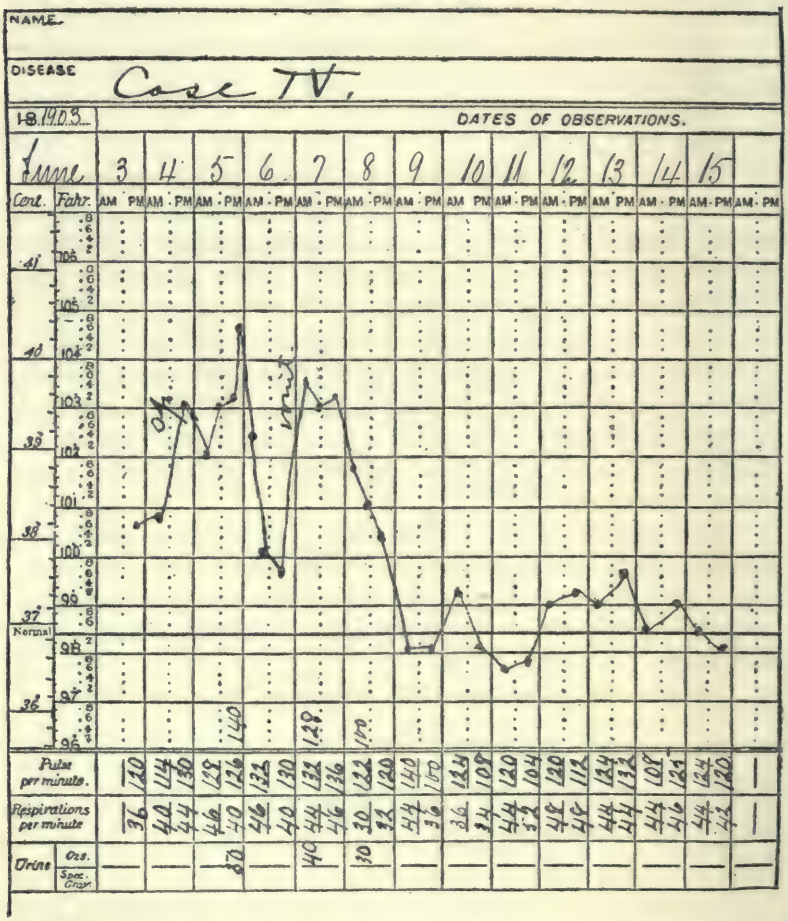
This patient upon admission was not thought very sick. Evidently both pneumonia and peritonitis developed in the hospital. It is not unlikely that they were sequent to a nasopharyngitis, which had given him fever, cough, and nose-bleed before admission.

Pneumococci were found in the peritoneal exudate.

The autopsies in all the cases were made by the writer, as was also the bacteriological examination. Cover-slips were stained by Welch's method and cultures made on Loeffler's tubes.

Comments.—Among the patients were three boys and two girls. The ages were three, three, two and a half, five, and three years. Some variety is shown in the distribution of the peritonitis; once the whole peritoneum was involved, twice chiefly the region of stomach and liver, and twice the hypogastric region. In no case did the patient live to form a localized abscess. All the cases would seem to belong to the diffuse

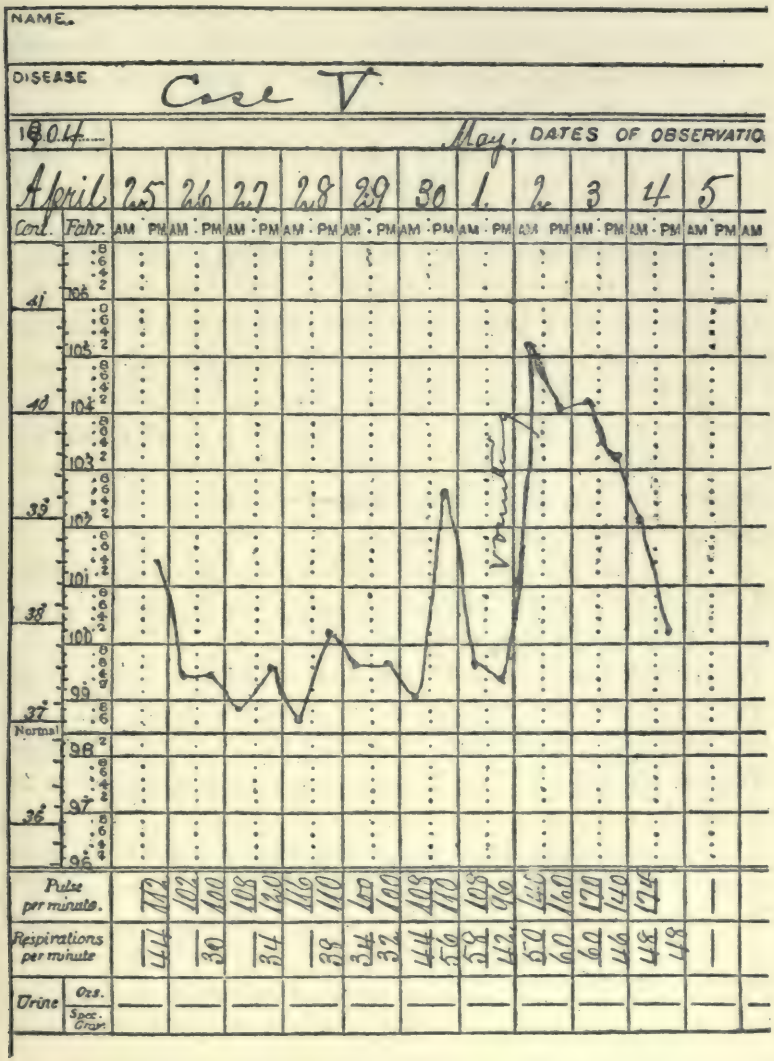
or spreading type of the disease. Four of the patients had empyema. In two the peritonitis followed the empyema, but in another two there is evidence that the process originated at about the same time in the pleura and peritoneum. At the



time of death in these two cases there was but one or two ounces of pus in the pleura. Pericarditis was present once.

Writers have called attention to the rather small percentage of the cases of this type of peritonitis which are associated with pneumonia. This might mean that the primary infection was intestinal or otitic, or that the pneumonia had resolved at

the time when peritonitis was diagnosed. Two of our cases had pneumonia at the time of death.



The deaths in all our cases, except Case IV, have occurred during the first stage of the disease, *i.e.*, the stage of high temperature. In Case IV the death occurred in the second stage,

when the temperature had been practically normal for a week. (See temperature chart.)

Case V shows the steady decline of temperature after the acute onset.

The condition of the bowels in pneumococcus peritonitis strikes one as most unusual. There has been diarrhœa in a large percentage of the reported cases. In four of our cases the condition of the bowels is noted. Case IV had diarrhœa in the second stage of the disease. In Case V the bowels moved satisfactorily with cathartics and enema, and at autopsy the whole length of the colon was found empty and contracted. In Case III the history says bowels moved regularly. Case I was said to have been constipated, but in the hospital the bowels moved as the result of cathartics and enema.

The distention has been much less than in peritonitis or other bacteriology. In no case was there great distention. The histories contain such statements as " abdomen moderately distended," " the abdomen of rickets," " distention relieved by enema," " abdomen not distended."

There has been evidence of pain in all cases, either by the child putting its hand to the abdomen or tenderness to pressure. Flexion of thighs is but once noted.

As to etiology, we can say little definitely. There is no reason to think any case due to intestinal infection. As there has been empyema in four cases and pneumonia in the fifth, it would seem likely that all cases were primarily infections of the respiratory tract.

It is not difficult to understand the fatal termination of these cases when one recalls the multiplicity of lesions, as, for instance, empyema, pericarditis, and peritonitis or empyema, peritonitis and probable meningitis. When we class pneumococcus peritonitis among the less virulent types, we must remember that the cures have been chiefly in cases where peritonitis was apparently primary, and where operation was not undertaken for a generalized process, but for a localized abscess anywhere from two weeks to several months from the beginning of illness. The mortality will always no doubt be

high where there are many pneumococcus lesions, and especially where, as seems likely in some of our cases, the peritonitis is part of a pneumococcus septicæmia.

One will be aided in the diagnosis of pneumococcus peritonitis in the presence of infections of the respiratory tract, if he places most reliance upon abdominal pain and tenderness. One must not rule out peritonitis, because, after the acute onset, temperature begins to subside or the patient seems better.

Peritonitis must be kept in mind so long as there is abdominal pain and tenderness, even though temperature is normal, bowels move regularly, and there is little or no distention.

THE TREATMENT OF THE STUMP IN APPENDICECTOMY.

BASED ON A PATHOLOGIC AND BACTERIOLOGIC STUDY OF THE APPENDIX.

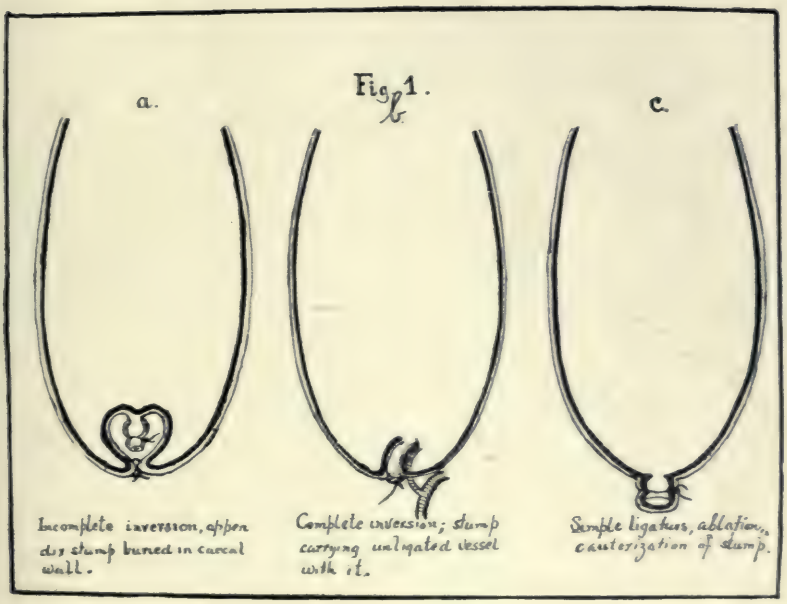
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We have innumerable casuistic reports on appendicitis, almost as many detailed descriptions of the anatomy and pathology of the appendix, and a proportionately large number of methods of treating the stump. Yet a careful search of the literature fails to reveal a single article in which the special treatment of the stump is based on definite anatomical, pathological, or experimental data. I therefore undertook to discover if it were not possible by a combination of clinical, experimental, and pathological methods, to determine upon one rational method of dealing with the appendix stump; for surely, unless all the methods are equally good, one of them must be the best, and thus be entitled to a place among the so-called " typical operations."

The result of my investigations is, that simple ligature of the appendix, ablation of the organ distally to the ligature, and cauterization of the stump, is the simplest and safest method of dealing with the diseased vermiform appendix. Dogmatism and surgery do not go hand in hand. There will always be cases where the judgment and ingenuity of the operator must regulate the method of procedure. The appendix may be too friable or gangrenous, or the adhesions may be too dense, to permit of simple ligature and cauterization. Yet, in the main, the fact holds good that, in the ordinary run of both acute and interval appendicitis cases, the most rational method of dealing with the appendix consists in simple ligation, fol-


a.
b.
c.
Fig 1.
Incomplete inversion, appendix stump buried in caecal wall.
Complete inversion; stump carrying unligated vessel with it.
Simple ligature, ablation, cauterization of stump.

lowed by cauterization. Whether the cauterization be done with the actual cautery or with pure carbolic acid makes no material difference. Personally, I prefer the actual cautery, because the heat exerts a bactericidal action at some distance from the point of application of the incandescent platinum, whereas the acid acts only on the surface. Moreover, by dividing the appendix with the cautery one guards against the escape of fæces, and consequent infection of the operation field.

In general, the methods of treating the stump may be grouped under three heads, as follows:

(*a*) Ligation of the base of the appendix, ablation of the organ distally to the ligature, and inversion of the stump by means of Lembert sutures passed through the peritoneum of the cæcum. (Fig. 1, *a*.) In these cases the appendix stump is *inverted into the wall of the cæcum.*

(*b*) Ablation of the organ without previous ligature of its base, and inversion of the stump *into the lumen of the cæcum;* Lembert sutures over the site of inversion. (Fig. 1, *b*.)

(*c*) Simple ligation, ablation of the organ distally to the ligature, and cauterization of the stump. (Fig. 1, *c*.) The disinfected stump is dropped back into the peritoneal cavity.

I shall try to show that both methods, *a* and *b*, are dangerous, and that method *c* is not only free from these dangers, but also possesses distinct advantages.

In method *a* the appendix stump is invaginated into the *cæcal wall.* It is impossible to invaginate it into the cavity of the cæcum, because the base of the appendix has been ligated preliminary to ablation of the organ. A glance at Fig. 1, *a*, will show that we have buried an infected stump in a closed cavity. If the stump has been cauterized, and thus disinfected, before inversion into the cæcal wall, the method is nevertheless a dangerous and unreliable one; for the inevitable exudate that forms is bottled up in a cavity under conditions which are particularly favorable to abscess formation. That such a procedure is likely to lead to serious trouble is not merely an *a priori* deduction, for Herman [1] reports a case from Professor

Rydygier's clinic, where, five days after an interval appendicitis operation, in which the stump was treated thus, an abscess formed in the cæcal wall, perforated into the general peritoneal cavity, and caused death.

Covering the ligated stump with a previously prepared cuff of peritoneum is only a modified way of locking it up in a closed space, and is open to the same objections. Professor Riedel, who, of all the German operators, has been most zealous in his advocacy of American methods of dealing with appendicitis, says: "I consider the suturing of a peritoneal cuff over the appendix stump as a very dangerous procedure. As regards going so far as burying the infected stump in the cæcal wall, this must absolutely lead to perforation into the lumen of the cæcum. If the inverting sutures hold, and the adhesions are strong enough, we need not fear an intraperitoneal rupture, but need only consider the disadvantage resulting from an ulcer in the cæcum as a result of the intracæcal rupture." [2] Riedel draws attention also to the insecurity of this method, in those cases where the cæcal wall is infiltrated and brittle, as it so often is in cases of acute appendicitis.

In method *b* the appendix stump is inverted directly into the lumen of the cæcum. There is therefore no danger of imprisoning a stump exudate, for drainage into the cæcal pouch is complete. We are, however, brought to face two other serious dangers. In this method it is impossible to pass a ligature around the base of the appendix, for such a ligature would prevent complete inversion of the stump. The result is, that for a time at least, the field of operation is in free communication with the infected cavity of the fæces-laden cæcum. Sudsuki [3] has shown that in 57 per cent. of the 500 cases that he examined, the lumen of the appendix contained fæces, and Hansemann [4] goes even farther, saying that fæces are always found in the appendix lumen, irrespective of the presence or absence of Gerlach's valve. On theoretical grounds, therefore, if on no others, it is not advisable or surgical to expose the operative field deliberately to a source of infection, if such a step can be avoided.

This, however, is not the only objection to the complete inversion method. The objection about to be mentioned has, with one exception, never been brought out in surgical literature. I refer to the danger of secondary hæmorrhage. The accounts of the blood supply as given by Nothnagel,[5] Fowler,[6] Deaver,[7] and all the larger hand-books of anatomy, are as follows:

"An anastomosis takes place between the superior mesenteric, ileocolic, right and middle colic arteries by means of arches, from which secondary loops are given off. From one of these secondary loops an appendicular artery arises, in connection with a branch which supplies the cæcal region. The appendicular branch, the essential nutrient artery of the appendix, passes along the free edge of the mesenteriolum, giving off branches to the appendix along the way. In case the mesentery is absent, *the artery passes beneath the peritoneal coat.* In exceptional cases the vessel may pass directly to the tip of the organ, and then be reflected into the submucosa."[6] The anatomic fact that in a fair proportion of cases the appendicular artery runs in the wall of the appendix is one of prime importance, and yet one which has received no clinical recognition, except in an article by Fowler, to be quoted later.

Without stating any reasons or authorities, Murphy, in his most recent article on appendicitis, summarily dismissed as untrue a fact firmly established both by anatomists and surgeons. He says, "The appendix has no vessel running parallel to its long axis; the vessels of the meso-appendix run directly through the mesentery, to the appendix wall."[8] Kelynack[9] states that the mesenteriolum is lacking in a small proportion of cases and is rudimentary in a large proportion. Ferguson,[10] of Toronto, examined 200 cadavers, and found the mesenteriolum absent in 50 per cent. of them. Monks and Blake[11] in 650 autopsies found an absence of the mesenteriolum in 16 per cent. of the cases. In all of these cases the vessel runs in the wall and parallel to the long axis of the appendix, and is caught only by ligating the tube as a whole or by dissecting out the vessel. Yet an essential point in the method of complete

inversion is that no ligature be passed around the appendix. It is for this reason that Fowler characterizes the method as "a brilliant device, lacking the element of safety." [12]

Here, again, clinical facts prove that the danger is a real and not a supposed one. Fowler states:

"The possibility of the existence of a sufficiently large vessel in the wall of the appendix, from which hæmorrhage might occur, suggested itself to me early in the use of Dawbarn's (complete inversion) method, and this was verified by experience later." [12] The case in question had four hæmorrhages of bright red blood (sixteen ounces in all, besides several large clots) which told markedly on the condition of the patient, but which, fortunately, responded to the administration of opium. A careful examination of the rectum failed to reveal any cause for the hæmorrhage, and Fowler concluded that the bleeding came from the appendicular artery.

This is the only case that I can find on record, and yet I have not the slightest doubt that the accident is one of not uncommon occurrence. I myself assisted at an operation followed by similar disagreeable hæmorrhages. The case was operated upon by Dr. Charles Elsberg, at Mt. Sinai Hospital, New York City, and I am indebted to Dr. Elsberg for the notes on the case. The operation was done under local anæsthesia (owing to a mitral valvular lesion). Dawbarn's method of complete inversion of the stump was executed. Twenty-four hours after the operation the patient complained of intense abdominal cramps. An enema was given, and was followed by the expulsion of about eight ounces of bright red blood and numerous clots (no hæmorrhoids or other rectal lesions). The patient gave every evidence of this hæmorrhage, his pulse ranging from 118 to 128. After twenty-four hours of comparative quiet, the cramps again set in, and were again followed by the show of a copious hæmorrhage, followed later in the day by smaller quantities of blood. Under dermatol and opium, with absolute quiet, the hæmorrhages ceased.

Dr. Charles Mayo, of Rochester, Minnesota, kindly sent me the notes of a case similar, in practically all its details, to

the two already quoted, except that he crushed the base of the appendix with an enterotribe before inverting it. The patient, "thirty-six hours after operation, began to pass copious, bright red, bloody stools," as a result of which the pulse-rate ran up to 150 beats to the minute. The symptoms, although alarming for forty-eight hours, finally responded to treatment. Dr. Mayo explained the hæmorrhage on the basis that some branch of the appendicular artery had not been ligated. Hæmostasis is certainly as basic a law of surgery as is asepsis, and on this ground alone it seems to me irrational to execute a method, following which we may encounter a hæmorrhage, in however small a proportion of cases.

Fowler[12] brings to bear even another objection to the method. He states that we are never sure of having inverted the stump into the *lumen* of the cæcum. He thinks that, in a certain number of cases, it is merely crowded in somewhere between the mucous and serous coats of the cæcum, where it may slough and cause a pericæcal abscess. He quotes a case of his, where he inverted the stump into the cæcal lumen, as he thought, but where he found it at autopsy lying between the mucosa and muscularis.

Thus far, then, I have tried to show that incomplete inversion (into the cæcal wall) and complete inversion (into the cæcal lumen) are, in theory and practice, unsurgical procedures. It remains merely to demonstrate that simple ligation of the appendix, ablation distally to the ligature, and cauterization of the stump, is a safe and rational method. In order to show this I shall resort to experimental and clinical proofs, demonstrating that the objections urged against the method are not tenable. And in demonstrating this, I hope to develop facts showing that the method possesses distinct advantages.

One of the main objections to the method is that the ligature forces mucous membrane into apposition with mucous membrane, and that we cannot therefore hope to secure firm union. Morris[13] says: "In ligating an *artery*, opposed surfaces of the tunica intima become adherent; whereas, in an

appendix the opposed surfaces of the mucosa, or of bared lymphoid tissue, do not become adherent," and " the bacteria in the lumen of the appendix are quick to attack the ring of tissue disabled by the compression anæmia, under the ligature, and thus cause perforation." These two statements practically conventionalize one serious arraignment that has been brought against the method of simple ligature and cauterization.

In order to investigate the matter, I ligated various appendices with catgut and silk, and then made serial sections through the ligatured portion parallel to the long axis of the appendix. Invariably I obtained the same picture as shown in Fig. 2, which represents a section taken directly through the centre of a ligated appendix. As may be seen, mucosa is not brought into contact with mucosa, as Dr. Morris states, but is crowded back for fully one-eighth of an inch (viewed macroscopically) on both sides of the ligature, and, moreover, so crowded back as to close off the lumen completely, and thus prevent the germs in the appendicular lumen from attacking the so-called line of " compression anæmia." Moreover, as may be seen, the stump is quadruply fortified, in that it is covered over by (1) the pulpy lymphoid tissue, (2) a thick layer of the resistant submucosa, (3) a layer of muscularis, (4) a layer of serosa, in addition to being shut off by the infolding of the mucosa.

Ochsner [14] rightly remarks that no other tube in the body, so small as the appendix, contains so large an amount of muscular tissue; and it is this excess of muscular tissue which, in part, fortifies our stump. A ligature properly tied around an appendix crushes aside all the coats exactly as does the Doyen enterotribe when applied to the intestine. I can find no record in literature of a microscopical study of the effect of a ligature on the appendix. Rousse [15] studied the effect of a ligature on the Fallopian tube, and found that, when properly applied, the ligature caused almost exactly the same picture that I have described in the case of the appendix. By this means he disproved the contentions of the Fraenkel school, that the tube lumen was not obliterated permanently

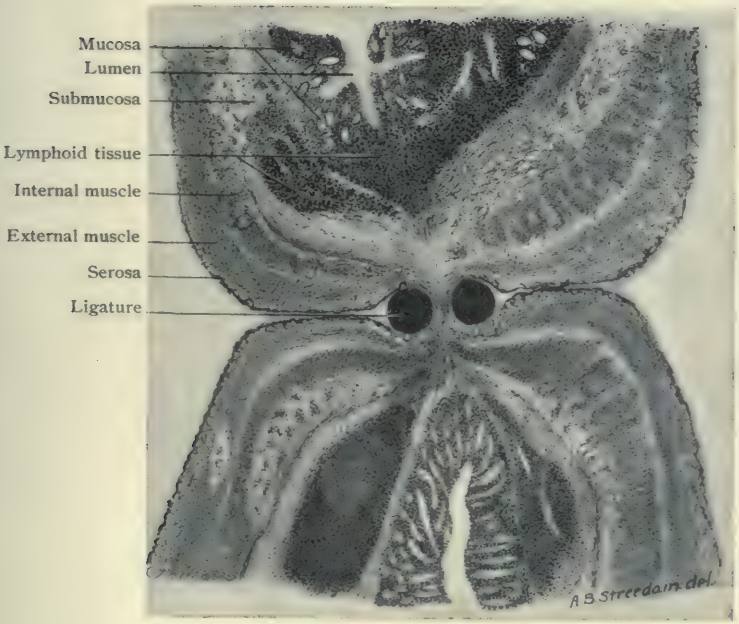


FIG. 2.—Showing the appendicular lumen shut off by the retraction and infolding of the mucosa, and the closure thus formed, protected and reinforced by all the other layers.

by simply ligating it. Lilienthal [16] has described the macroscopical p·:lpification of the mucosa as the result of a ligature, but the true nature of stump formation is best seen in the microscopical sections.

As regards Morris's statement that perforation occurs after simple ligation of the stump, I can only say that during my two and a half years' interneship at Mt. Sinai Hospital, where we operated upon from 300 to 500 cases of appendicitis a year, I never encountered a perforation in a case where the ligature was applied about an appendix, in a non-gangrenous and not too friable area; moreover, Dr. Howard Lilienthal informs me that this same statement holds good for his twelve years of service as adjunct and attending surgeon to the same institution.

The next serious objection to the method is that it leaves uncovered, in the free peritoneal cavity, an infected stump. In our operative technique, we always disinfect the stump, either with pure carbolic acid or with the actual cautery. In order to ascertain whether these methods secured perfect sterilization, I ligated several appendices and cauterized the stumps with carbolic and the cautery. Dr. Libman, assistant pathologist to Mt. Sinai Hospital, kindly took these appendices in charge. Those that had been treated with carbolic acid he washed in sterile salt solution in order to get rid of any possible excess of the acid, which might otherwise interfere with bacterial growth. After a two weeks' stay in sugar bouillon, the media showed absolutely no growth, and Dr. Libman reported the stumps to be sterile. The argument, therefore, that an *infected* stump is left in the peritoneal cavity does not hold good. Of course, these stumps do pour out a secretion after cauterization, but there is no structure in the human organism better fitted to take care of this secretion than is the peritoneum.

The only remaining argument against the method is, that an uncovered stump leads to the formation of adhesions which so frequently distress the patient after operation. To disprove this statement, I can call to my aid only data collected from

post-mortem findings. I have examined, post-mortem, the cæcum of two patients who had previously been operated upon by the simple ligature and cauterization method for appendicitis. In both instances, that portion of the cæcum where the longitudinal striæ meet to mark the site of the appendix was perfectly smooth and glistening. Nowhere was the original site of the appendix base to be found.

Lilienthal [16] states that an adhesion forms to the cauterized end of the stump, and that as the stump sloughs off this adhesion drags it away from the cæcum. In a personal communication to me, Dr. Lilienthal states that he has examined several cases post-mortem, with the end in view of investigating the question of adhesion formation about the appendix stump after ligature and cauterization. In every case (he confined his examinations only to cases where adhesions did not exist before operation) he found the cæcum free from adhesions, with a small, smooth, dimpled spot to mark the former point of origin of the appendix. One of the cases that he examined had died seventy-two hours after operation, and even in this case the cæcum was perfectly smooth, the site of the appendix being discovered only after a careful search.

We know that the tendency of the peritoneum to form adhesions, displaying itself sometimes in a most erratic fashion, has not been explained by any suitable hypothesis. Presumably, according to Nothnagel,[17] the primary cause of adhesion formation resides in the fact that endothelial cells have been destroyed by trauma or inflammation, and their place taken by connective tissue. According to this theory, simple incision or local inflammation of the peritoneum may lead to the development of localized or widespread adhesions. Nothnagel further says that "adhesive inflammation may be circumscribed to a small area of the peritoneum . . . and may develop from the very outset of a diseased condition of the appendix, the adhesion formation then running a slow and insidious course." If, therefore, the genesis of adhesion formation lies primarily in the appendicular inflammation, it is impossible to claim the assurance for any one method of treat-

ment, that adhesion formation will positively not occur. For example, Eliot [18] reports that after an appendicectomy done by the method I am defending, adhesions formed, causing intestinal obstruction. He therefore forsook the method and adopted the procedure of inverting the stump and covering it with peritoneum. Following this method, however, he reports that he also encountered a case of obstruction due to adhesions around the site of inversion.

The point is, that if adhesions form around the site of inversion, they form to stay and make trouble, whereas, if they attach themselves to a stump which has been ligated tightly enough, their traction on that stump will tend to hasten its separation from the cæcum, thus doing away with the pain consequent upon the pull of the adhesions, and obviating the possibility of intestinal obstruction due to a band.

I have tried to show that the method of simple ligation and cauterization is an absolutely safe one, whereas the other methods are all open to serious criticism both from theoretical and practical view-points. It is not my intention strenuously to contend that there is one, and only one, method of dealing with the appendix stump. There is no cut and dried rule that can be made to fit any one surgical procedure. However, I do feel that it is rational to adopt that method which, possessing all the elements of safety, can yet be more speedily accomplished than all other methods. Saving of time, even though that time be reckoned in minutes, is a great surgical desideratum. My last plea for the simple ligation method is that it undeniably does save time.

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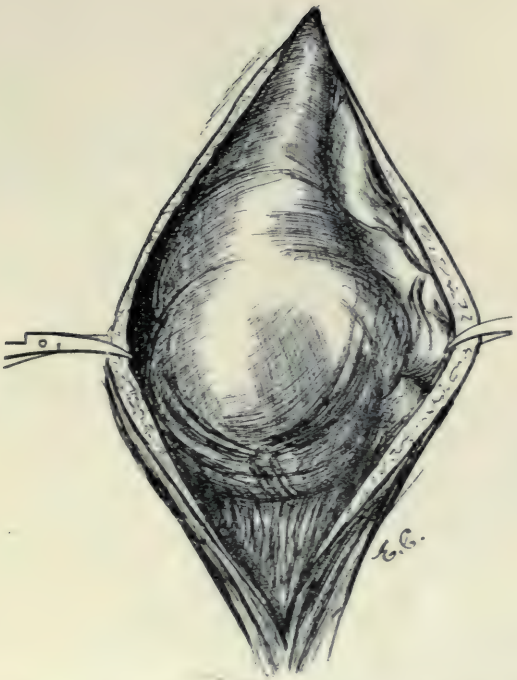


FIG. 1.—Abdomen opened, showing cæcum but no appendix.

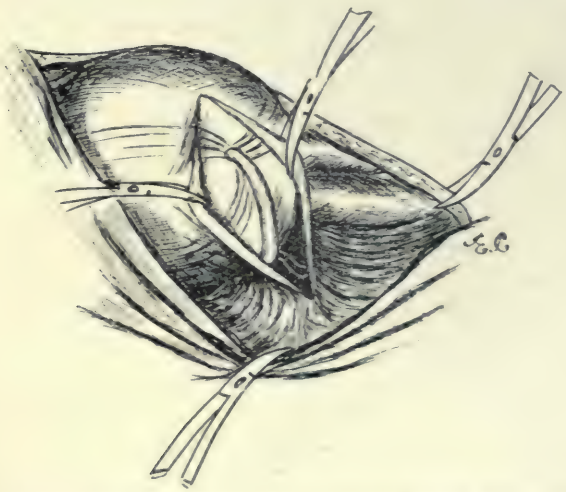


FIG. 2.—Cæcum elevated and visceroparietal peritoneum opened, showing appendix and two small vessels.

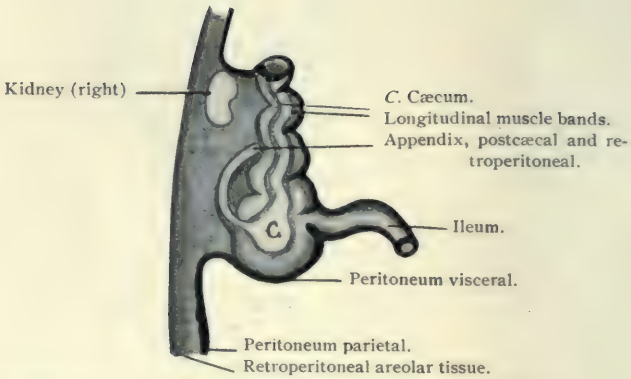


FIG. 3.—Diagrammatic representation of postcæcal retroperitoneal appendix.

APPENDIX VERMIFORMIS CONCEALED IN THE POSTCÆCAL RETROPERITONEAL SPACE.

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In view of the scant mention in text-books of surgery and anatomy of the anomalous and rare situation of the appendix in the postcæcal retroperitoneal tissue, and the natural inference that the appendix is congenitally absent if at least part of it is not found intimately covered with peritoneum, this case is of interest.

The clinical history of the case presents no unusual features. S. A. M., dentist, male, single, birthplace and residence in Wisconsin, twenty-five years old; alcohol, tobacco, and venery negative; began in February, 1903, to have attacks of abdominal pain, nausea, tenderness localized over appendix area, and moderate distention of abdomen, with irregularity of bowels. Between attacks, patient tired easily, and did not fully recover his health. When seen first, December 6, 1903, with Dr. J. M. Lewis, of Bloomington, Wisconsin, patient was just recovering from an attack which had been more severe than any previously experienced, during which he vomited once. On examination, the appendix area still gave localized tenderness.

The abdomen was otherwise negative, as was the urine. Diagnosis of chronic catarrhal appendicitis was made and operation recommended, in view of the progressively increasing severity and number of attacks, and the patient's failure to recuperate fully in the intervals. The abdomen was opened by the usual muscle-splitting procedure, and the cæcum identified and brought into the wound. The longitudinal bands and ileocæcal junction were easily made out, but no appendix could be seen. (Fig. 1.) Starting at the point where the longitudinal bands should meet, search was systematically made in all directions for any trace of the appendix, without success. Also there were no signs of

a mesenteriolum. The peritoneum was reflected from a point above the point of junction of the longitudinal bands, without any signs of adhesion or other inflammatory products to the wall of the iliac fossa and neighboring viscera, and presented, except for the high reflection of peritoneum and absence of mesenteriolum, pretty accurately the relations after the removal of an appendix.

The cæcum was next raised at a point four or five inches above its lower end, and with the fingers of the other hand surrounding the gut was carefully drawn up, while the fingers palpating the postcæcal area worked downward. When the lower hand reached a point one-half inch above the ileocæcal junction, a small mass was encountered behind and internal to the cæcum. As I followed this mass towards the middle line and upward, it was found to end in a slight rounded enlargement. Following it downward and outward, behind the cæcum, I brought up at the cæcum, at a point where, if continued, the longitudinal bands would meet. I repeated the procedure of tracing the appendix, and definitely identified it. From a point in the angle of the two anterior longitudinal bands, the peritoneum was incised outward to the fossa wall, and the margins separated. With the end of the cæcum elevated, the appendix was isolated and freed and delivered at the opening of this peritoneal wound. (Figs. 2 and 3.) In freeing it, two small vessels only were tied, and there was almost no bleeding. The direction taken by the appendix, beginning at the cæcum with which it was in close relation throughout, was downward and outward, backward and outward, and making an acute angle turn upward and inward to the end above and internal to the ileocæcal junction. The appendix was easily ligated and removed in the usual way, treating the stump by inverting it, and securing it by a purse-string suture. The second peritoneal wound was then closed by continuous catgut suture and the abdominal wound closed with layer sutures.

The part of the appendix removed on inspection was entirely without peritoneal covering, about three inches long, slender, except at the extremity, where there was slight clubbing, distinctly pale, and anæmic looking. On opening the canal, the proximal third was dilated and presented the usual signs of a chronic catarrhal inflammation, while the rest was obliterated except for a distance of one-quarter inch at the extremity, where

dilatation was also present. No concretions were found. Convalescence was satisfactory, and the patient has reported complete relief from symptoms six months after the operation.

In a case of this sort, if one could determine the position of the appendix beforehand, it would not be necessary to open the abdominal cavity to accomplish the removal of the appendix. There seemed to be nothing in the history of the case or the physical signs to point to this anomalous situation.

The importance of investigating the postcæcal region where an appendix is wanting in the usual places is apparent from the history of another patient.

Case 2 was taken ill while travelling in the East, and a diagnosis of appendicitis was made. At operation, an intestinal ulcer and diverticulum were found, but no appendix.

The surgeon thus describes the condition: "In the place of the appendix was a continuation of the longitudinal muscular fibres of the bowel as a mere cord, without any adhesions in the region of the head of the cæcum, which one would naturally look for had the appendix sloughed away." He inclined to the belief that the appendix was congenitally absent. This may be, and likely is, a case of fibrous cord appendix.

In view, however, of Case 1 cited above, and the absence of evidence excluding a postcæcal position of the appendix, the question whether or not there is an appendix in Case 2 will become all important should symptoms suggesting appendicitis arise in the future.

In the literature on the location of the appendix, Treves [1] states that "it frequently lies behind the cæcum," but does not specify its relation to the peritoneum.

Richardson [2] and Cobb state "it is often retrocæcal," but do not specify in regard to the peritoneum.

Further on they say, "The appendix is sometimes situated in a fossa of the peritoneum behind the cæcum," and again, "It is rarely, if ever, absent."

Gray [3] does not mention a retroperitoneal location, but says it may be found in one of the fossæ about the ileocæcal junction.

Quain[4] states "Sometimes it is entirely behind the cæcum, and in this position may be quite free, or firmly bound down to the peritoneum."

"It has a peritoneal fold, the meso-appendix, containing its vessels and nerves and attached to above half the length of the appendix, the distal portion being generally quite free and entirely surrounded by peritoneum."

Monks and Blake,[5] in a critical review of the autopsy findings of 656 cases in which death occurred from other causes than the appendix, report one case in which the appendix lay "behind peritoneum under cæcum, and extended upward to lower border of right kidney."

McBurney[6] states "The appendix is normally an intraperitoneal organ, except in those cases in which very early adhesion and obliteration of the contiguous peritoneal coverings of the colon and the posterior abdominal wall will have occurred." "It may lie behind the cæcum, or even in the retroperitoneal tissue behind the cæcum, as has been mentioned."

Parker[7] examined seventy appendices in the dissecting-room, and does not speak of a retroperitoneal position.

Boas,[8] citing Bardeleben, Luschka, Tuffier, Maurin, Bryant, and F. von Sydow, says that in more than 96 per cent. of all cases the appendix lies intraperitoneally.

Hartley[9] cites Ferguson's report of seventy-seven out of 200 cases as "having the peritoneum so disposed as to allow an immediate involvement of the subperitoneal tissue by its perforation."

Maurin reports (Hartley) all of his cases as being completely surrounded by peritoneum. He also quotes Kelynack as asserting that all his cases showed the appendix to be "a truly intraperitoneal organ." Further, Hartley gives it as his opinion "That some of these cases reported as being extraperitoneally placed appendices are only appendices herniated into some of the fossæ at the junction of the ilium and cæcum, or are partly intra- and extraperitoneally placed."

Reviewing the literature as indicated in the Index Medi-

cus and Bibliographia Medica, as far back as the time of publication of Monks and Blakes's article mentioned above, I found no reference to this situation of the appendix. More recently V. Bergmann [10] mentions this anomaly as a possibility.

In view of the absence of inflammatory signs, absence of mesenteriolum, the situation of the appendix as described, and the condition of the appendix as found upon removal, it seems clear we have to deal with a congenital anomaly of position of the appendix. The explanation of the condition, concurred in by Professor Thomas Dwight in a personal communication, is to be sought in the development of the intestinal tract and peritoneum.

Originally in the embryo, the intestine is freely movable and covered by peritoneum, and as the appendix develops from the cæcum it too is covered by peritoneum. Later, during development, certain parts, among which is the ascending colon and sometimes the cæcum, in varying extent, become attached behind by the adhesion and obliteration of the apposing peritoneal surfaces—visceral and parietal.

It is not uncommon to see the upper posterior surface of the cæcum adherent to the posterior abdominal wall, and in the case of a retroperitoneal appendix this process of adhesion and obliteration of apposing peritoneal surfaces has, during development, extended beyond normal limits to such a degree as to involve the appendix by inclusion and obliteration of its peritoneal covering.

Under the circumstances, the mesentery of the appendix also disappears, and its vessels are to be found in the retroperitoneal areolar tissue.

Aside from its anatomical interest, the retroperitoneal appendix may in any individual case have a surgical importance, from the fact that complete congenital absence of the appendix is, indeed, rare; and if one does not at operation readily find the appendix in the abdominal cavity or herniated in the fossæ about the cæcum and ileocæcal junction, one should not conclude that the viscus is absent, until a thorough

and careful search has been made of the postcæcal retroperitoneal region.

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[2] Park. "Surgery by American Authors," Vol. ii, p. 375.
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[4] Quain's "Elements of Anatomy," Tenth Edition.
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[6] "International Text-Book of Surgery," Warren and Gould, Vol. ii, p. 396.
[7] Senn's "Practical Surgery," 1901.
[8] Boas, L. "Diseases of the Intestine," 1901.
[9] Hartley, Frank. Dennis' "System of Surgery," 1896, Vol. iv, p. 393.
[10] V. Bergmann and Bull. "Practical System of Surgery," 1904, Vol. iv, p. 349.

REMARKS ON APPENDICITIS.

BASED ON AN ANALYSIS OF 219 CASES OPERATED UPON AT LEBANON HOSPITAL UP TO APRIL 1, 1904.

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If one need to make an apology for bringing the subject of appendicitis before the Surgical Society, ours will be the fact that our experience has ever added to our own knowledge, and therefore we feel that a review of a considerable number of cases may aid in the study of this disease, and also the fact that it seems to us well to carefully consider certain propositions regarding the treatment of appendicitis, notably the method of operating, and the question as to whether to operate or not in acute cases at or near the time when perforation has taken place.

The 219 cases herewith analyzed may be classified as follows:

	Cases.	Deaths.
Class 1. Chronic, recurrent, relapsing; interval operation ...	43	0
Class 2. Acute, including perforative, gangrenous, suppurative, local, and more or less diffuse peritonitis	157	7 (*i.e.*, 4.4 per cent.)
Class 3. Fulminating, and cases with general septic peritonitis diagnosticated prior to operation. Many of the cases were practically moribund	19	19 (mortality, 100 per cent.)
Total	219	26 (12 per cent.)

		Cases.	Deaths.
Cases operated on by Dr. Syms.	Class 1	27	0
" " " " "	Class 2	44	1 (2.2 per cent.)
" " " " "	Class 3	4	4 (100 per cent.)
Total		75	5 (6.6 per cent.)

	Cases.	Deaths.
Cases operated on by Assistants.* Class 1	16	0
" " " " Class 2	113	6 (5.3 per cent.)
" " " " Class 3	15	15 (100 per cent.)
Total	144	21 (14.5 per cent.)

We were very much surprised at the view expressed by Ochsner, namely, that cases of acute appendicitis should not be operated upon after the twelfth to twenty-fourth hour, until resolution had apparently taken place and the case could be treated as an interval one, or until a large perityphilitic abscess had formed which might be opened by the extraperitoneal incision, years ago known as the Parker incision. The treatment proposed by Ochsner is more or less generally known as the starvation treatment, consisting of lavage of the stomach and otherwise absolute rest of the stomach and upper intestinal tract, nourishment being supplied by rectal alimentation entirely. For this method of treatment Ochsner claims great things, and he has attracted many advocates to it. But it seems to us that a review of the cases here presented would show that it would be applicable alone to the cases of general septic peritonitis, which we believe to be fatal in practically 100 per cent. when operated upon.

The cases of chronic, recurrent, relapsing appendicitis, known as interval cases, have presented no deaths in our experience, and we believe it reasonable to expect that a clear record should be obtained, certainly when ideal surgery can be performed. If cases of general septic peritonitis are to be considered universally fatal, it would leave for our consideration that list of cases included under Class 2, *i.e.*, acute perforative, gangrenous, suppurative appendicitis with localized abscess,

* We wish to thank our co-workers, the Assistant Attending Surgeons to the Hospital, Drs. Henry Roth and William Shufelt, for their valued and skilful co-operation. It is but fair to state that they operated on a large proportion of cases that came in at night, or that, on account of their urgency, had to be operated upon at odd times, and therefore they probably encountered cases of more severity than occurred in the author's list.

localized or diffused peritonitis, but not general peritonitis nor general peritoneal sepsis. Of these cases we have lost one in this series of forty-four cases (2.2 per cent.), and our assistants, out of 113 cases, have lost six, making a total of seven, or 4.4 per cent. Of these 157 cases it would be impossible to conceive that anything like so small a death-rate could have obtained had the expectant or starvation treatment been pursued. They embraced cases in which the gangrenous appendix lay free in the abdomen, and where general peritoneal sepsis would have been inevitable but for operative interference. There were cases of peri-appendicular abscess with adhesions more or less firm, but in a proportion of which it would be fair to suppose that general infection would have taken place save for the relief given by operation. There were cases in which there was gangrene of the omentum, gangrene of the cæcum, perforation of the bowel, beside perforation of the appendix; and it is impossible for us to believe that more than a small majority of these cases could possibly have survived an expectant treatment, and those only by some such lame process of nature as spontaneous opening of an abscess externally or into one of the hollow organs of the abdomen. When one considers such a series of cases as reported by Ochsner, one must take for granted the accurate diagnosis, for the conditions were not seen and could only be surmised; and we think any surgeon must concede that to make an accurate diagnosis of the intra-abdominal condition in cases of suppurative inflammation is impossible. All Ochsner's cases lacked the accurate knowledge which is obtained by operation.

It seems to us that such a plan of treatment as applied to this class of cases must merely mean the survival of the fittest. We all recognize the fact that a patient on the eighth, tenth, or twentieth day after the initial stage of an appendicitis is comparatively safe, if he be alive; but we must not lose sight of the fact that he passed through a period of danger before reaching this stage, and that many who have tried to do likewise have died.

It is the theory of Ochsner and those who hold with him,

that operation is extremely dangerous at the period when perforation of an appendix has taken place, and we agree that such operation is dangerous unless performed with the utmost care. We also maintain that the ideal of surgery and of medicine is that we should not have cases come to operation at this period, for every case of appendicitis, if properly and carefully observed, should come to operation before this period is reached. But when the surgeon finds his patient at his first visit in this condition with an appendix ruptured, with a localized peritonitis, or a localized abscess, there is no opportunity for him to choose, if he believes as we do; and he must then operate; but he must so operate that the operation shall not present as high a degree of mortality as would the expectant treatment in these cases.

At the meeting of the American Medical Association in 1902 we reported our nine fatal cases of appendicitis. These were the only cases of death from operation in our series dating from the year 1888. Unfortunately, we are unable to present the full number of cases, so that we cannot give the percentage, but suffice it to say that in all our experience we have had but two deaths among patients belonging to Class 2, namely, acute perforative, gangrenous, suppurative appendicitis with localized abscess, localized or diffused peritonitis. (In the cases here reported our one death represents but 2.2 per cent.) Ochsner states that operation at this period has a death-rate of 20 per cent. We have lost but 2.2 per cent. as shown above. And we believe this small percentage is owing to the method of operating.

We wish to lay stress on the proper manner of operating upon cases embraced under the Class 2. Unfortunately, the statement has been many times made, and is too often acted upon, that the peritoneum is capable of safely dealing with a surprising amount of infection or of infective material; for the ideal surgical procedure is the one which does not subject uninvaded peritoneum to any infection whatsoever. Our endeavor in operating on these cases has been to thoroughly

protect the uninvaded peritoneum from infective material by the most careful and thorough gauze sponging or packing.

Peri-appendicular abscesses are opened in a systematic manner. After the field has been thoroughly exposed, and the point for entrance of the abscess chosen, with the region thoroughly walled off by sponges, the abscess is opened by separating adhesions very gently, and the first escape of pus is controlled by the pressure of the finger of the operator over the opening. From then on the operator uses small marine sponges held in forceps, which are passed like a series of buckets at a fire. As soon as a sponge is lifted from the opening it is replaced by another, and all of the pus is absorbed in these sponges, none of it being allowed to escape into the wound. After the tension is removed from the abscess, the opening is carefully enlarged and the evacuation can take place more rapidly. Finally, the abscess cavity is emptied, and the surface cleansed with peroxide of hydrogen (which we feel will destroy pus, but which will not disinfect tissue). In almost all cases nowadays we continue the separation of adhesions to the point of removing the appendix; but we do not in the least agree with those who claim that it is safe to evacuate pus into the peritoneal cavity, and then rely upon disinfection with hydrogen dioxide, or any other means; nor with the opinion that, having removed the diseased appendix, no matter how, the peritoneum will be able to take care of whatever infection may have been superinduced. The operation is completed by careful and thorough packing of the wound with gauze for the purpose of drainage. This packing is so placed as to keep the intestines well within the abdomen and to keep healthy intestine from contamination with the already infected area. In some cases we use rubber tissue and gauze, but when the infective process has been a severe one we use gauze alone. If this packing is properly done, it will never cause intestinal obstruction; but if the pads of gauze are placed between the folds of intestine it will frequently be productive of trouble. Before leaving this phase of the subject, we would submit that in these recorded cases our mortality of 2.2 per cent., and in

all of our other appendix operations,—number not known,—our single death in this class of cases is a better record than we could have obtained by the expectant plan of treatment.

When one comes to the question of cases of general septic peritonitis, which our experience has presented a mortality of 100 per cent., when operated upon, one should welcome with joy any plan of treatment recognized as proper which will relieve the surgeon from the responsibility of operating, and which will relieve the community and the public at large from the great disadvantage that they are put to by every case of appendicitis that dies following an operation. When one considers the greatest good to the greatest number, it must be conceded that each case of appendicitis dying without operation is a great benefit to the public, while every case of appendicitis dying after operation is a public calamity. We have always held that in the history of every case of appendicitis there has been a period when that case could and should have been operated upon safely and successfully. In other words, ideally speaking, there should be absolutely no mortality rate from appendicitis.

Some time ago, expressing this view to a colleague, the latter cited the instance of a patient whom he had recently seen, who was operated upon within seven hours of the first symptom of appendicitis, and yet it was found that his appendix was gangrenous, and there was general peritoneal sepsis, from which the patient died. But we maintain that this was not within seven hours of the first symptom, and asked our friend if it was not at least ten years after the first symptom, and on further inquiry it was found that for years the patient had suffered from well-marked symptoms of appendicitis, such as slight localized tenderness, slight localized pain, chronic indigestion, abdominal distention, and that train of symptoms which should either be cured by the general practitioner or which should lead him to turn the patient over to the surgeon.

Among the nineteen cases belonging to Class 3, viz. (general septic peritonitis), which died, many were almost moribund at the time of operation. These were not by any

means all cases of fulminating appendicitis, but many of them had belonged to Class 2, and had passed from that more favorable condition during days of unnecessary delay before they had been brought to the hospital. Feeling the confidence which we do in Ochsner, and having the conviction that operation in these cases will result in no good, we would gladly place all these cases on the starvation plan of treatment, but for the fact that no one can be positive of the diagnosis. A number of our cases which we have saved have apparently been cases of general peritonitis, seeming so to be even when the abdomen was opened; but the very rapid benefit following operation has proved to us that they were not cases of general peritonitis, but that they really belonged to Class 2. We feel that there is a great distinction to be made between cases of diffuse peritonitis and cases of general peritonitis. To find the abdomen full of seropurulent material is not enough to establish the diagnosis of general peritonitis, and we feel convinced that general peritonitis is necessarily a fatal condition. Our method of dealing with these cases, where the disease is not walled in nor localized by adhesions, is to remove the diseased appendix and any gangrenous mesentery or omentum, to cleanse the local field with hydrogen peroxide, and to mop out the excessive excretion. We no longer resort to flushing in any cases, and we do not use wide-spread gauze packing in the abdomen, but attempt merely to thoroughly pack the original site of the disease in a way that will drain it.

When one comes to a patient who can evidently withstand the operation, but in whom the chances of recovery seem to be but the slightest, one is confronted with perhaps the most difficult question which presents itself in surgery; that is to say, whether to operate or not. But from the patient's point of view, the slight chance of recovery by operation is the only chance he has; and it certainly seems that the question becomes a moral one, and that the patient is entitled to this one chance, and that the surgeon should not shirk the responsibility. But we always look with longing and regret to those precious hours which have been lost by delay, and to that period that has

existed in every patient's case when he might have been operated upon with no fear of a fatal result. So far, we have operated upon every case which has been admitted to Lebanon Hospital except one. He was really moribund, and died a few hours after admission.

In closing, we would like to express the deep sorrow and mortification we feel at the apparent lack of knowledge, or appreciation of the danger of appendicitis, on the part of many physicians. At Lebanon Hospital we are constantly admitting patients who are in a precarious condition, owing to the fact that their physicians have kept them from operation day after day, apparently not recognizing the gravity of the case,—certainly not through inherent ignorance, but it must be on account of lack of careful investigation of the cases. It is pitiable at the time of operation—perhaps on the seventh or eighth day—to find a hopeless condition which surely did not exist at a period long after the disease should have been thoroughly recognized, and when operation could have been expediently and safely performed. Fortunately, this deplorable mistake is being made with ever decreasing frequency, and we should all look forward with hope to the time when the public and physicians will recognize the fact that appendicitis is absolutely a surgical and not a medical disease.

DOUBLE TRAUMATIC ILIAC DISLOCATION OF THE HIP.

REPORT OF A RECENT CASE, WITH A REVIEW OF THE LITERATURE OF THE SUBJECT.

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(*From the Surgical Service of Dr. Wainwright.*)

THE rarity of double traumatic dislocation of the hip seems to justify the report of the following case from the Moses Taylor Hospital in Scranton.

E. E.; eighteen years old; driver in coal-mine; has always had good health, and has had no previous injury or disability of either hip. On May 11, 1904, two hours before admission to the hospital, as he was riding on the bumper of a loaded coal-car, he was thrown by a sudden jolt upon his hands and knees directly in front of the car, which then struck him in the sacral region. He managed to drag himself from beneath the car by means of the mule traces. He was brought to the hospital by an ambulance, and on examination the typical signs of double iliac dislocation of the hip were evident. The great trochanter on each side was three inches above the Nélaton-Roser line with the head of the bone plainly palpable on the dorsum of the ilium. There were also contusions over the sacrum and an abrasion of the right knee. Further examination was negative. Under ether both sides were easily reduced by Bigelow's method. The knees were bandaged together and no other retentive dressing applied. The patient was confined to bed for four and one-half weeks. At the end of this time he could walk with no pain or disability in the hips. Movements in the hips, measurements, and the relations of the bony prominences were normal. There was, however, foot-drop on the right side, due presumably to pressure of the

knee bandage on the external popliteal nerve as it winds around the head of the fibula. This foot-drop rapidly cleared up.

Stimson says that, compared with other injuries, dislocations are infrequent,—the proportion to fractures being about one to ten. In his series of 705 recent traumatic dislocations seen at the Hudson Street Hospital, New York, from 1894 to 1899, there were nine of the hip. Kroenlein, in 400 dislocations, saw eight of the hip. Kneer tabulated 1068 dislocations, 9.5 per cent. being of the hip. This percentage is high, as ambulatory cases were not included. Billroth, in his clinic, 1860 to 1876, saw fifteen cases of hip dislocation, and Weber, in thirty-eight years at Bonn, saw twenty-two. Kroenlein gives 2 per cent. as the number of dislocations referable to the hip. Of the above authors, only one, Kroenlein, reported a double dislocation of the hip.

In 1887, Niehans (*Deutsche Zeitschrift für Chirurgie,* Vol. xxvii) collected twenty-five cases of double dislocation of the hip and added one of his own.

In 1891, Six (Wurtzburg Thesis) found three more cases, and reported one of his own. A careful review of the literature up to the present time has revealed only one other case. This was reported by Pfeiffer in 1887 (*Boston Medical and Surgical Journal,* 1887). This with our own case makes a total of thirty-two recorded. The rarity of cases in the literature of the past few years may in part be due to the fact that operative surgery has to a large extent diverted attention from non-operative injuries.

It is seldom that the account of the exact manner of the accident is clear enough for one to draw a definite conclusion as to the mechanism by which these severe dislocations occur. It generally seems, however, that the force is applied while the thighs are in flexion, as was the case with the present patient.

Twenty-five of the cases were young or middle-aged men, one was a woman and two were children. Where the result is stated, reduction was accomplished in twenty-three cases. Four remained unreduced and two cases died. One death

(Niehans) was from shock after resection of one side, and the other (Six) from shock after a successful reduction of both sides.

There were six cases, including the present, of the double iliac variety. Of these only three were reduced. These cases in detail were as follows:

Case I.—Wood. Man, 46 years old; had double posterior dislocation since a fall at six years of age. No reduction.

Case II.—Pritchard. Man, nineteen years old; railroad employee. While working in a stooping position on the track was knocked down. Reduction easy.

Case III.—Catalogue of Pathological Cabinet, New York Hospital, 1860, No. 31. Man, twenty-seven years old; quarry-worker; injured in a premature explosion. Arm badly torn, of which he died at seventh month. Hips not reduced. This patient said the trouble with the left hip was congenital. It would seem that this case should be excluded. (It has, however, been counted among these cases by Niehans and Six.)

Case IV.—Liebl. Fireman, twenty-five years old; was thrown against a solid body by a forward movement of his engine. Considerable shock and local blood effusion. Attempt at reduction sometime later under ether failed. Resection four months after injury, with death two days later in collapse .

Case VI.—Present case.

Inasmuch as Six's table appeared thirteen years ago, and is very inaccessible in this country, we reproduce it here, with the addition of Pfeiffer's case and our own.

SIX'S TABLE OF DOUBLE TRAUMATIC DISLOCATION OF HIP.

No.	Reporter.	Date.	Age.	Sex.	Right.	Left.	Therapy.	Result.
1	Singowitz.	1830	?	Man.	Obturator.	Obturator.	Reduction.	Recovery.
2	Andreini.	1845	30	Man.	Iliac.	Infrapubic.	Reduction.	Recovery.
3	Jung.	1846	30	Man.	Ischiadic.	Iliac.	Reduction.	Recovery.
4	Bruns, Kneer.	1851	50	Man.	Iliac.	Iliac.	Reduction tried.	Failed.
5	Kirn.	?	?	Woman.	Obturator.	Iliac.	Operation.	Recovery.
6	Wood.	1852	46	Man.	Iliac.	Iliac.	No treatment.	Unchanged.
7	Barker.	1854	19	Man.	Obturator.	Obturator.	Reduced.	Recovery.
8	Pritchard.	1854	19	Man.	Iliac.	Iliac.	Reduced.	Recovery.
9	Hodgen.	1855	?	Boy.	Ischiadic.	Obturator.	Reduced.	Recovery.
10	Warren.	1857	?	Man.	Obturator.	Iliac.	Reduced.	Recovery.
11	Bowrienne.	1857	35	Man.	Ischiadic.	Iliac.	Reduced.	Recovery.
12	New York Hospital Pathological Cabinet.	1860	27	Man.	Iliac.	Iliac.	Reduction tried.	Failed.
13	Boisnot.	1867	40	Man.	Pubic.	Iliac.	Reduced.	Recovery.
14	Fischer.	1868	37	Man.	Iliac.	Ischiadic.	Reduction tried.	Failed.
15	Steiner.	1869	29	Man.	Obturator.	Obturator.	Reduced.	Recovery.
16	Pollard.	1872	53	Man.	Obturator.	Iliac.	Reduced.	Recovery.
17	Kunschert.	1874	?	Man.	?	?	Reduced.	Recovery.
18	Crawford.	1876	30	Man.	Iliac.	Ischiadic.	Reduced.	Recovery.
19	Packard.	1878	40	Man.	Obturator.	Iliac.	Reduced.	Recovery.
20	Allis.	1897	42	Man.	Iliac.	Obturator.	*	
21	Schinzinger.	1879	40	Man.	Ischiadic.	Pubic.	Reduced.	Recovery.
22	Roberts.	1880	65	Man.	Iliac.	Obturator.	Reduced.	Recovery.
23	Niehans.	1881	25	Man.	Iliac.	Iliac.	Resection (right).	Death.
24	James.	1883	44	Man.	Obturator.	Iliac.	Reduced.	Recovery.
25	Liebl.	1883	?	Man.	Iliac.	Iliac.	Reduced.	Recovery.
26	Ebner.	1883	18	Man.	Obturator.	Obturator.	Reduced.	Recovery.
27	Kroenlein.	?	?	?	Pelvic.	Pelvic.	?	?
28	Gibson.	?	?	?	?	?	?	?
29	Cooper.	?	?	?	?	?	?	?
30	Pfeiffer.	1887	8	Girl.	Iliac.	Ischiadic.	Reduced.	Recovery.
31	Six, Schonborn.	1891	27	Man.	Ischiadic.	Iliac.	Reduced.	Death.
32	Lewis.	1904	18	Man.	Iliac.	Iliac.	Reduced.	Recovery.

* Right side reduced by De Forest Willard. On left side reduction tried, but failed. Dr. Willard kindly traced this case in July, 1904. He found the right hip normal. The left femoral head was still on the obturator foramen. The patient walks very comfortably, but with a limp. He attends regularly to his daily duties. This accident occurred in 1879.

FRACTURE OF THE TIBIAL TUBERCLE.

BY MARTIN W. WARE, M.D.,

OF NEW YORK,

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A DESCRIPTION of this fracture, which it has been my rare fortune to encounter, is found wanting in the text-books of surgery and special treatises on fractures. A search of the current literature, however, has brought to light a few cases which corroborate the findings in my case.

The history is as follows: E. H., aged sixteen years, was suspending his body-weight in the vertical position while swinging on rings. He suddenly let go his grasp and, in falling to the ground, landed on his feet; his knees gave way under him and he fell on his back, unable to rise thereafter.

He was seen six hours after the injury. His right knee was swollen and discolored. The dimple normally located on either side of the ligamentum patellæ was obliterated, and there was a slight discoloration visible. The limb was in the semiflexed position and extension voluntarily was impossible. Upon placing the hand over the knee, crepitus was at once perceptible. The tubercle of the tibia was movable, and when brought down upon the head of the tibia, crepitus could be elicited. Dancing of the patella could easily be made out.

Treatment.—The fragment, so readily replaceable, was held in place by zinc oxide plaster, and over this a plaster cast was moulded to the limb, and absolute rest was enjoined. The cast remained on two weeks, and was again replaced for another two weeks. At the expiration of this time union was firm, but a large callus was visible at the site of the fracture. There was some stiffness. It took several months thereafter for the limb to regain its function.

The diagnosis was confirmed by a skiagraph, of which an illustration (Fig. 1) is appended.

The accompanying illustration (Fig. 2), according to Poland,[1] shows the tubercle to have an occasional separate centre of ossification, which eventually joins the upper epiphysis at the age of sixteen to eighteen; but, as a rule, the tubercle ossifies by extension downward of the upper epiphysis. When, therefore, a separate centre of ossification is at hand, we may speak of a true epiphyseal separation, but, as a rule, fracture exists. A communication of the synovial bursa under the ligamentum patellæ with that of the knee-joint is often present (Quain), in consequence of which an effusion into the knee-joint may be expected.

Poland (*Loc. cit.*) records ten cases, in all of which indirect violence was responsible for the injury, but in the majority of instances crepitus was absent.

Osgood's [2] experience in the main substantiates the observations of Poland.

In agreement with the above-mentioned authors, Schlatter,[3] who has most recently contributed to this subject, cites the right side as being most frequently affected, but refers to direct violence as responsible for a number of fractures. In his seven cases the knee-joint was not the seat of an effusion, and he thinks this only obtains if the whole epiphysis is torn off.

The treatment advocated by all is extension in plaster of Paris.

As to prognosis, Poland (*Loc. cit.*) says the result differs from fracture of the patella, inasmuch as osseous union may always be expected if the fragments are brought into apposition.

On the other hand, Schlatter (*Loc. cit.*) says the nearer the age of the patient approaches the period of adolescence, the less the time required for healing. In two cases it took all of two years before healing was completed.

Like in my own case, the healing of the recorded cases in each instance was followed by marked callus formation.

Bearing on this point, I wish in conclusion to refer to an affection of the tubercles of each tibia incident to direct violence inflicted on these structures due to a fall upon the knees. Tem-



FIG. 1.—Fracture of tibial tubercle.

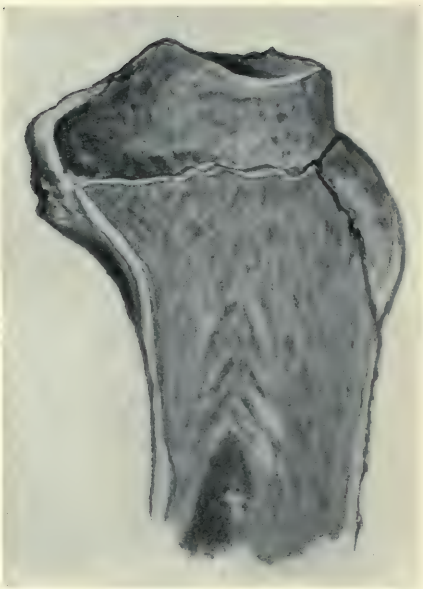


FIG. 2.—The centres of ossification forming the head of the tibia. (Poland.)

porarily incapacitated for walking and without any medical advice, functional activity of the knee-joints was restored, but a marked increase in the size of each of the tubercles was manifest ever thereafter. This case presented itself before the advent of the X-rays, and the diagnosis could only be tentatively made.

All of the fractures of the tibial tubercle occurred in males, but O'Donoghue [4] records one in the case of a female.

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[1] Poland. Traumatic Separation of the Epiphyses, 1901.
[2] Osgood. Lesions of the Tibial Tubercle occurring during Adolescence. Boston Medical and Surgical Journal, Vol. cxlviii, No. 5.
[3] Schlatter. Verletzungen des Schnabel foermigen Fortzatses der Oberen Tibia-Epiphyse. Bruns klinische Beitr., Vol xxxviii, Heft 3.
[4] O'Donoghue. Avulsion of the Tibial Tubercle. Boston Medical and Surgical Journal, June 11, 1903.

ABDOMINAL CRISES CAUSED BY MECKEL'S DIVERTICULUM.

REPORT OF TWO RECENT CASES, WITH A REVIEW OF THE LITERATURE OF THE SUBJECT.

BY OLIVER C. SMITH, M.D.,

OF HARTFORD, CONN.

CASE I.—F. P., a fairly healthy child, ten years of age, on the evening of May 28, 1904, was suddenly taken with vomiting and severe pain in the right lower abdomen. Patient was seen by me in consultation with Dr. E. O. Elmer at 1 P.M., May 29. At that time the child had the appearance of commencing general peritonitis. An anxious countenance, abdominal dyspnœa. Pulse, 120; rectal temperature, 102.5° F. Abdomen presented general tympanitic distention. Right rectus very rigid. Marked tenderness over McBurney point. The bowels had been moved by calomel and enema. Heart and lungs normal, save coarse bronchial râles. Kidneys secreting freely. No bladder irritation. Diagnosis, acute appendicitis with probable perforation. Leucocyte count not made. Operation under chloroform anæsthesia at 5 P. M. One hundred cubic centimetres of sanguinopurulent serum escaped upon incising the peritoneum. A dense, round mass was felt directly under the incision. This proved to be, not the appendix, but a distended, inflamed, and *perforated* Meckel's diverticulum. A small quantity of bile-stained fæces was escaping from the perforation, which was near the attachment to the ileum. The omentum was adherent to the distal end of the diverticulum. Plaques of lymphatic exudate marked the efforts of nature in walling off the destructive process. The intestine was purse-stringed, with No. 2 chromic gut, one-half centimetre from its junction with diverticulum. The latter was clamped and severed, and the intestine turned in, as is commonly done in dealing with the stump of an appendix. The diverticulum was three to four centimetres in length and two centimetres in diameter. Its mucosa was deeply engorged and bulging into the perforation. Apparently but a small amount of fæces had escaped into the abdominal

cavity. The mesenteric glands were enlarged in either direction from the seat of the disease. The appendix, which was found deep in the right iliac fossa, was brought up with difficulty, as the cæcum was closely attached to the pelvic wall. It was found sharply bent upon itself, with thin adhesions attaching its proximal third to the intestine. Upon opening it after removal, it was found to have a normal mucosa at either end, but contained a catarrhal secretion in the middle third. The abdomen was lightly drained; there was but slight shock, and the patient made an uneventful recovery.

Case II.—K. B., male, aged nineteen years. Personal history negative, until June, 1903, when a short attack of intestinal obstruction occurred, accompanied with vomiting and severe pain. The condition was relieved by high enemata.

September 20, 1903, he was seized with a similar attack late in the evening, following an indigestible meal. High enemata were unavailing. A hypodermatic injection of one-quarter grain of morphine, repeated within an hour, failed to control pain. Peristalsis was constant. Vomiting occurred at frequent intervals, the patient remaining on his hands and knees in great distress. The abdomen was considerably distended, and the recti muscles were rigid. The most marked point of tenderness was two centimetres below and one centimetre to the right of the umbilicus. Lavage of stomach and laparotomy performed eighteen hours after onset. Incision through right rectus below umbilicus. About 100 cubic centimetres blood-stained serum escaped upon opening the peritoneal cavity. Two coils of ileum were found constricted; the constriction being due to a twisting of the bowel around a diverticulum, extending from a point on the ileum eighteen inches above the ileocæcal valve to the left pelvic wall. This diverticulum was also twisted upon itself to the point of obstruction, the distal end being distended and of a deep color. The diverticulum was excised between ligatures, its base at the proximal end being inverted into the intestine and closed by purse-string suture. The appendix vermiformis, which was found congested, was removed. Towels wrung out of hot salt solution were applied to the injured intestines, their normal color gradually returning. The patient reacted well, and the vomiting and pain gradually subsided. Bowels moved on the third day. Primary union. Uneventful recovery.

The literature on the subject of intestinal crises caused by Meckel's diverticulum is meagre.

Cases of intestinal obstruction similar to my second case have of late years been not infrequently observed, but instances of acute inflammatory, gangrenous, and perforative diseases of the diverticulum similar to my first case are decidedly rare.

Dr. William Perrin Nicholson, of Atlanta, Georgia, reported such a case in the *New York Medical Journal* of June 23, 1900. His case was operated upon on the third day, and, while vomiting ceased and some improvement followed the operation, the patient died eighteen hours later. Autopsy showed the diverticulum had caused no mechanical constriction, and the intestinal obstruction was due to the inflammatory process about the gangrenous diverticulum. Dr. Nicholson at this time collected reports of six cases. Two of these were reported by Dr. Richardson, of Boston, one of which was saved by operation.

Dr. C. R. Gildersleeve reported a case in the *Medical News,* Vol. lxxii, in which operation was declined, and autopsy revealed obstruction of the ileum, caused by Meckel's diverticulum, which had become twisted upon itself, and its contents were incarcerated. The diverticulum terminated in a fibrous cord, forming a complete ring through which the ileum passed.

This case, therefore, should hardly be classed as one of disease of the diverticulum, *per se.*

The fourth case in this collection was reported by Dr. J. H. Elliot in the *Boston Medical and Surgical Journal,* 1894. The patient was operated upon four days subsequent to the attack, and died upon the second day following operation. The diverticulum in this case extended from the convex part of the ileum to the umbilicus. It was obstructed and gangrenous.

The fifth case in the series is reported by Guirrard in the *Bull. et Mém. de la Soc. de Chir.,* Paris, 1898, Vol. xxiv.

The patient presented all the symptoms of appendicitis. Was seen in consultation by the operator nine hours after onset of the attack, but was not operated upon until the following day. Patient died. Autopsy revealed a Meckel's diverticulum seventy centimetres from the ileocæcal valve, the distal end of which was adherent to the mesocolon near rectum. The report does not state that the diverticulum was gangrenous, and this case may belong to the class of mechanical obstructions caused by a diverticulum rather than to disease of the diverticulum itself.

The sixth case cited in this series is reported by Dr. W. Mintz in the *Deutsche Zeitschrift für Chirurgie,* Vol. xlviii. This patient, like the others, suffered from intestinal obstruction. A diagnosis of appendicitis was made. He was treated with ice and opium, death occurring on the sixth day. Autopsy revealed a diverticulum sixteen centimetres long and eighty centimetres from ileocæcal valve. Pathological details

are not given, but it was presumably a case of obstruction due to the presence of the diverticulum rather than obstruction caused by disease of the diverticulum itself.

Searching the literature further, I find a case which should be classed with the first case I have related, reported by C. R. Darnall, M.D., United States Army, in the *New York Medical Journal*, January 12, 1901.

His patient was a United States volunteer soldier, twenty-two years of age. He was attacked June 8 with pain in the abdomen, and a feeling of weakness and exhaustion. He was admitted to the Battalion Hospital at Talle the day after his attack. He was then suffering tympany, vomiting, abdominal pain, and tenderness. He was given magnesium sulphate, which he did not retain, and morphine hypodermatically. An enema was used without effect.

Unfortunately, he was attacked on shipboard, and the conditions suitable for operation were not obtained until three days after the onset.

The abdomen was opened in the right iliac region; the cæcum and appendix were found to be normal. The wound was closed. Patient died three days after the operation. Autopsy. Abdomen very much distended. Abdominal wound in good condition. General peritonitis existed. A Meckel's diverticulum was found six inches long, three feet above the ileocæcal valve. The distal extremity was attached to the abdominal wall at the umbilicus. The proximal end bore a large gangrenous patch, near the centre of which was a perforation two centimetres in diameter.

This, then, is a case corresponding to the one which I have reported.

Dr. A. L. Wright, of Carroll, Iowa, reported before the Dubuque Medical Society, June 22, 1899, a case of recurring abdominal crises in a male aged twenty-seven years, upon whom he reported, in the interval following, an unusually severe attack of abdominal pain, prostration, vomiting, and constitutional disturbance. His physicians made a diagnosis of recurring appendicitis, and the operation was performed with the expectation of removing the appendix. Instead, a diverticulum was found three inches in length. The distal end of the diverticulum was thickened and rough, bearing evidences of inflammatory attacks. The caliber at the proximal end was much narrowed. The wall of the ileum at its junction with the diverticulum was extremely thin, but had not perforated. For this reason a portion of the ileum, three inches long, was resected and an anastomosis accompanied by means of a Murphy button. Patient recovered.

In a thesis read before the Faculte de Médécine de Paris by Henri Blanc in 1899, on "Contribution à la Pathologie du Diverticule de Meckel," are collected from various clinics

of Europe, and a few from the literature of this country, records of forty-eight cases of abdominal diseases due to Meckel's diverticulum. Eighteen of these were cases of intestinal obstruction due either to volvulus or invagination of the ileum. Of the remaining thirty, twelve were cases of acute inflammatory and perforative disease of the diverticulum, causing in most of the cases general peritonitis and death. The balance of the series was made up of instances of cysts, tumors, and herniæ, all caused by Meckel's diverticulum. Of the twelve inflammatory and perforative cases, eight were fatal. Three were saved by operation, and of one the result is not stated.

Meckel's diverticulum is usually found springing from the ileum, two or three feet from the ileocæcal valve. It is estimated by anatomists that it occurs in about 2 per cent. of the human species. Rarely it remains patulous and open at the umbilicus, but it generally has a blind extremity and is of varying length. It may be continued as a cord to the umbilicus, or may become attached to the lateral pelvic wall. It is a remnant of the vitellin duct of the embryo which has failed to become obliterated.

From its rarity in the human subject, abdominal crises due to Meckel's diverticulum can never be of frequent occurrence; but it is one of the conditions which the surgeon must bear in mind when making a diagnosis, and when searching in the abdominal cavity for the cause of the obstruction and of the peritonitis. No class of cases demonstrate more clearly the great importance of early laparotomy, for, whether we are dealing with obstruction from a diverticulum or from a general peritonitis due to a perforation, we are dealing with an emergency, every hour the existence of which, unrelieved, adds to the gravity of the situation, and reduces steadily and surely the chances of recovery.

In the twenty-one cases of general peritonitis due to gangrene, perforation, or both, of Meckel's diverticulum, it will be seen that fifteen proved fatal. In none of these fatal cases was an operation performed *earlier than the third day.*

The three cases which have recovered in this country are

Dr. Elliot's, Dr. Wright's, and the one herein reported. The credit for the recovery of this case is due largely to Dr. E. O. Elmer, who acted with great promptness in calling counsel and preparing the family and the patient for an operation.

The abdomen was opened eighteen hours after the onset of the attack, and but little credit, comparatively, is due to the operator, for the result would have been successful in any hands.

Time is of the utmost importance in determining the result of operation in these cases. It is in this class of cases, rather than that of acute and complete obstruction, that dangerous delays are likely to occur, for the inflammatory lesion, even with its fatal outpour into the abdominal cavity, may not produce obstruction; and in the absence of the more alarming obstructive symptoms the physician is more likely to allow himself to wait, in the hope that the trouble may be relieved without operation.

THE USE OF THE SEGMENTED RING IN GASTRIC AND INTESTINAL ANASTOMOSES.[1]

A CLINICAL AND EXPERIMENTAL STUDY.

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AND

ALFRED H. GOULD, M.D.,

OF BOSTON.

(*From the Surgical Laboratory of the Harvard Medical School.*)

In 1902 a segmented ring was described by Harrington (*Boston Medical and Surgical Journal,* November 6, 1902), the objects of which were two: (1) To furnish a mechanical aid to assist in the rapid and safe anastomosis of the intestines; (2) to make the contrivance collapsible into such small segments that their subsequent passage through the intestines would be devoid of danger or pain. The favorable reception given the ring by the profession during the past two years has encouraged us to make a report of personal cases to date, accompanied by the results of a series of animal experiments illustrating the process of repair.

Description of Ring.—The ring is made of hard aluminum in four sections. These sections are jointed firmly together by a small bar of steel, which has a shoulder and a screw-thread, and which serves as a handle. The outer surfaces of the ring are grooved to hold the ends of the intestines, which are tied in place by catgut purse-string sutures. The

[1] Read at the meeting of the American Surgical Association, June 15, 1904.

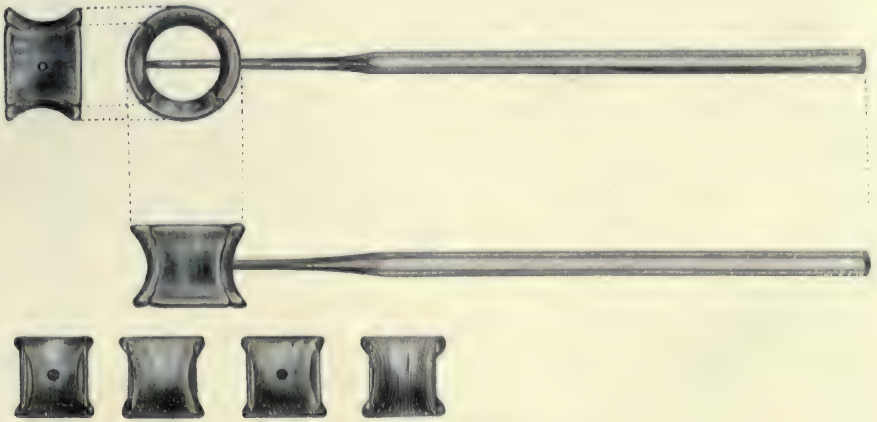


FIG. 1.—The segmented ring.

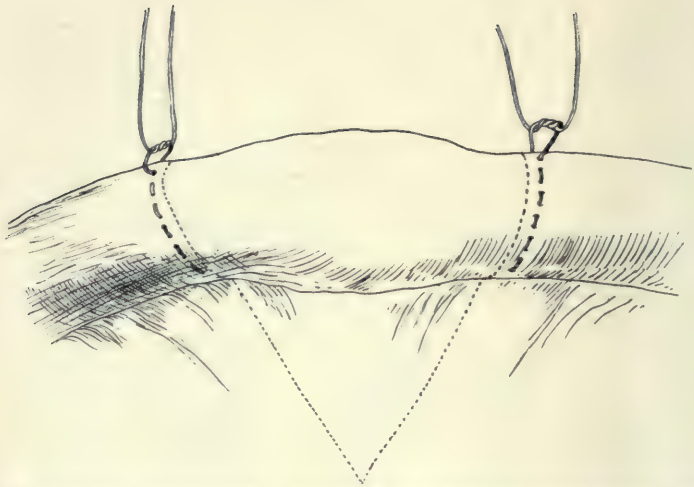


FIG. 2.—Preliminary introduction of purse-string sutures tied with one-half surgeon's knot.

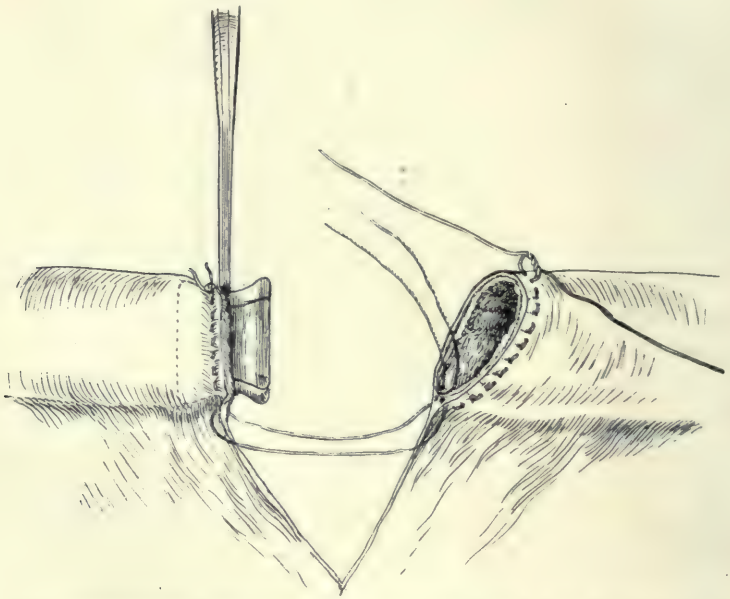


FIG. 3.—Bowel resected, ring half introduced, one gather stitch tied, mattress suture to mesenteric border.

segments fit together by means of sliding tongue-and-groove joints so rounded that they will not cut or catch in the tissues. The ring is made in three sizes. (Fig. 1.)

Diameter.	Width.	Weight of Individual Segments.
5/8 inch	1/2 inch	10 grains.
7/8 inch	5/8 inch	20 grains.
1 1/8 inches	5/8 inch	30 grains.

The middle size is best adapted for general use; the largest may be used for sutures of the large intestine; the smallest size is best adapted for children and for cholecystenterostomy.

ANIMAL EXPERIMENTS.

Technique.—The same technique is used both for end-to-end and for lateral anastomoses; but a slight difference in details makes a separate description necessary.

End to End. Clamps are applied in the usual manner a few inches from the field of operation, and a gather stitch of No. 2 plain catgut is placed on either side of the area to be resected. This stitch circles the intestine with bites deep enough into the muscular coat to insure its not slipping, and, in order to save time later, the catgut is lightly tied with one-half of a surgeon's knot without drawing the purse-strings tight. (Fig. 2.)

The bowel is next cut away up to one-eighth of an inch from the gather stitches, because a wide margin forms a wide inturn and a correspondingly thick scar. The weak point in mechanical aids is the difficulty in obtaining a secure joint at the mesenteric border, a danger which is avoided, with the ring, by putting in a mattress stitch at this spot. This stitch includes a portion of the mesentery on each side, but is not tied at once. (Fig. 3.) The ring is now introduced, and one gather stitch tied. The mattress stitch is next tied, followed by the tying of the second gather stitch. The cut bowels now lie smoothly end to end, and, by use of the handle, can be

easily moved about in convenient positions for sewing. The main stay of the suture is a Cushing's continuous stitch which penetrates the bowel into the muscularis mucosæ. This starts just to one side of the steel handle (Fig. 4) and passes around the intestine with frequent knots until it reaches the handle again from the other side. The handle is now unscrewed, leaving the ring held together by the purse-strings, and the suture continued over the hole just occupied by the handle. The cut edges of the mesentery are caught together by a few interrupted stitches. (Fig. 5.)

Lateral Intestinal and Gastro-intestinal Anastomoses. The gather stitch consists of two parallel arms crossing at one end. These arms are just wide enough apart to allow room for the incision. (Fig. 6.) The mattress stitch is omitted here, and a continuous stitch is employed to approximate the serous coats and form the anastomoses.

Hæmorrhage from the cut edges of the bowel is always controlled by tying the purse-strings, while one or two ties are usually necessary to control the bleeding from the mesentery.

It is desirable to leave the ring in place after finishing the suture, because, although having no influence upon the process of repair, it serves as a splint while the adhesions are being formed. If it causes a decided stretching of the intestines, the ring should be broken down before closing the abdomen. This is easily, and harmlessly, done by gently squeezing the circumference of the ring through the intestine. After twenty-four hours the swelling of the inverted edges of the suture is great enough of itself to hold the ring in place without the catgut purse-strings. The rings examined after one to three days were much more firmly grasped by the suture than they were at the time of the operation. The swelling of the edges of the anastomosis subsides after four to six days, leaving the gut lumen and the purse-strings stretched to a caliber considerably greater than that of the circumference of the ring. The ring accordingly collapses, although the catgut may not yet be disintegrated.

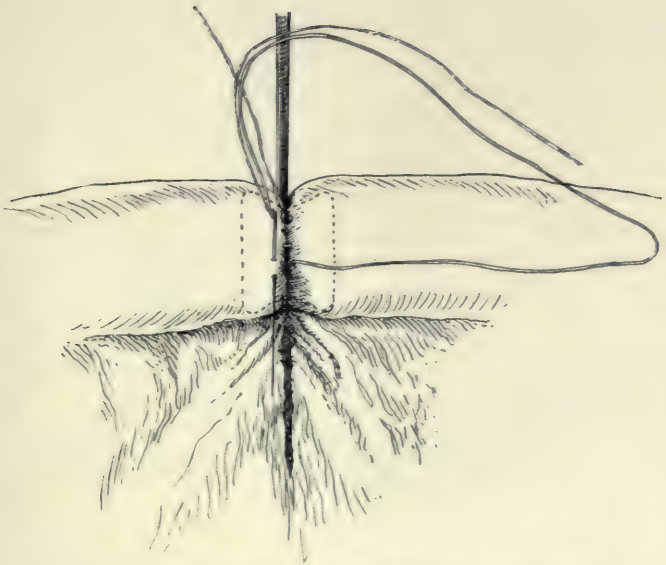


FIG. 4.—Continuous stitch beginning at one side of the handle.

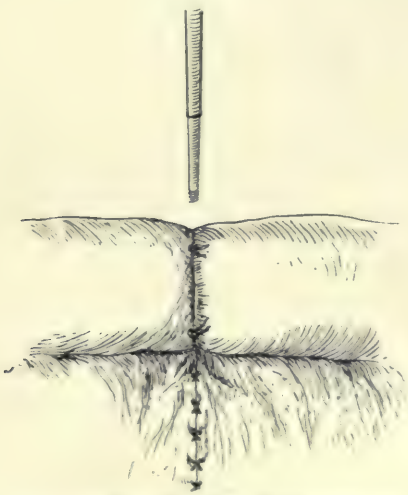


FIG. 5.—Handle unscrewed, suture completed.

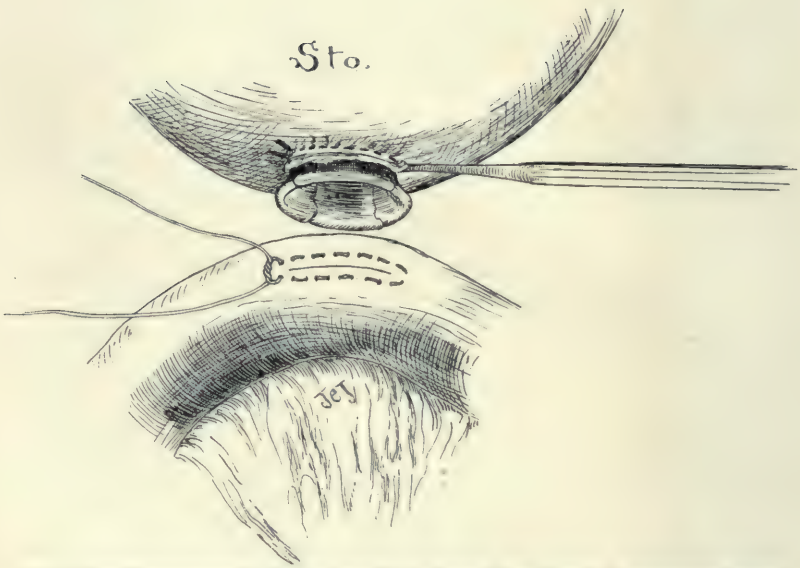


FIG. 6.—Gastro-enterostomy. Shows parallel positions of two arms of purse-string stitch. Purse-string tied on stomach side.

The passage of the segments through the intestines requires from one to three weeks. After gastro-enterostomy some or all of the segments fall back into the stomach, and, if it is patent, pass through the pylorus. That the transit through the pylorus is slow is evidenced by Experiment 17, where three of the four segments were found in the act of passing through the pylorus fourteen days after operation. After end-to-end anastomoses one or two segments pass on together, while those remaining may lie in place at the suture for several days longer.

The suture material used in these animal experiments for the continuous stitch was No. 1 Pagenstecher celloidin thread; for the mattress stitch, No. 1 chromicized catgut. No. 2 plain catgut was found most useful for the purse-string sutures. The rings used were made by Codman & Shurtleff, Boston.

Details of Animal Experiments.—A series of twenty-two experiments are reported below in which fourteen dogs and four cats were used, as follows:

End-to-end intestinal anastomoses	8
Lateral intestinal anastomoses	3
Gastro-intestinal anastomoses	7
	18
Gastrogastrostomies	4
	22

END TO END. (Dogs.)

Experiment.	Time Elapsed after Operation.	Condition of Suture at Autopsy.	Segments Found.
1	1 day	Intact	At site of suture.
2	1 day	Intact	At site of suture.
3	3 days	Slough of suture, too large ring.*	At site of suture.
4	7 days	Intact	Ileum.
5	7 days	Intact	Two in ileum. Two in rectum.
6	8 days	Intact	Ileum and rectum.
7	14 days	Intact	Not found (passed).
8	42 days	Intact	Not found (passed).

*The intestine in this case was so stretched over the ring that it was anæmic. As it was an early case, the importance of breaking down the ring, under such circumstances, was not recognized.

LATERAL INTESTINAL. (Dogs.)

9	5 days	Intact	Near suture.
10	10 weeks	Still alive	
11	4 weeks	Still alive	

GASTRO-ENTEROSTOMIES. (Dogs.)

12	3 days	Intact	Three in pylorus (stomach). One in small intestine.
13	7 days	Intact	Ileum.
14	7 days	Intact	Ileum.
15	10 days	Intact	Rectum.
16	12 days	Intact	Large intestine and rectum.
17	14 days	Intact	Three in large intestine and rectum.
18	21 days	Intact	Not found (passed).

GASTRO-GASTROSTOMIES. (Cats.)

To determine how long ring remains *in situ*.

1	24 hours	Intact	Segments held firmly in place.
2	3 days	Intact	Segments held firmly in place.
3	5 days	Intact	Segment still held in place, loosely.
4	6 days	Intact	Ring broken down. Segments *in situ*.

The Process of Repair.—The close approximation of two serous surfaces, which is characteristic of intestinal sutures, results in a rapid exudation from the apposed surfaces. This exudation appears in a very few hours and hermetically seals the wound. Every coat of the bowel is soon penetrated by this exudate, rapidly destroying the endothelium on the outside of the bowel.

Repair of the Mucous Membrane. For the first few hours after the suture the mucous membrane is the seat of a marked active hyperæmia with more or less bloody extravasation, the mucous edges being dark red and elevated from the coats below. This condition is followed by an exudation which extends into the glandular tissue until, at the end of

three days, the glands disappear about the cut edge for two to five millimetres. When a large invagination has been made, in the process of suture, the submucosa becomes so swollen and œdematous that it probably interferes thereby with the circulation of the mucous membrane. Under such conditions the slough of the mucous membrane is correspondingly extensive. The amount of destruction of mucous membrane varies somewhat; but usually the slough is about three to five millimetres in width. At the end of five days, the slough generally separates, leaving a clean line. The above series of changes takes place in all sutures, although a separate suture of the mucous membrane seems distinctly to retard the repair. The reproduction of glands is more rapid in end-to-end than in lateral sutures. If the inturn has been a moderate one, the mucous membrane will cover in the ulcer in about eight days. The glands themselves, though atypical in shape, possess all the characteristics of mucous glands. At the end of eight days the line of sutures is represented by a narrow scar situated in the middle of what was formerly the ulcerated area. After gastro-enterostomy and lateral intestinal suture, the cleaning away of the slough takes place quickly; but the subsequent ingrowing of the mucous membrane is slow, since the interval to be crossed is a wide one. The process is exactly analogous to the healing of a superficial ulcer on the surface of the body. In these cases mitotic figures were seen at the end of five, but were numerous only at the end of ten, days. The nuclear division, as a rule, first came in the mucosa of the stomach. On the tenth day a single line of cells starts from the stomach and rapidly crosses the floor of the ulcer. The complete closing in of the bare area is much hindered by the presence of sutures, which, even though absorbed, leave irregular holes that are but slowly smoothed over. At the end of twenty-one days the line of suture is covered by a continuous though low mucous membrane. The line of demarcation between the stomach and intestinal glands is a sharp one, and is situated near the centre of the old ulcer. These glands, though atypi-

cally shaped, have normal functional power. (Goblet cells, etc.) (Figs. 7–13.)

The new mucous membrane has no definite muscularis mucosæ. At first it rests upon a base of dense granulation tissue. This coat is very slow to repair; but, at the end of six weeks, a substitute muscularis mucosæ has been acquired, which consists largely of connective tissue, but in which are found fibres closely resembling smooth muscle. This layer has no sharp limits, and fades away into the scar tissue beneath.

Repair of the Serous Surfaces. The formation of plastic exudate does not cease with the resulting adhesion of the inturned serous coats, but appears externally for a distance of three to five centimetres beyond the line of suture, thus acting like an external callus. The transformation of the exudate into granulation tissue is rapid. In three days a large number of new connective-tissue cells have been laid down, among which are a few new blood-vessels arising from the vessels in the underlying muscular coat. Entire organization of the inner exudate requires at least seven, the outer at least ten, days. After complete organization, the connective tissue gradually disappears, finally remaining as a thick scar, which reaches for a varying distance over the adjacent bowel and, dipping down into the depth of the suture, holds the bowel walls firmly together by thick strong bands. Fourteen days are required for the completion of this sequence.

Repair of Muscular Coats. The muscular coats play a passive rôle during the first forty-eight hours after the suture. The muscle bundles are penetrated by extravasated blood and by exudate throughout their whole thickness. After the second day new blood-vessels bud out into the exudate and assist in its organization. When the inflammatory process has subsided, the muscle ends are held together by scar tissue arising from the intermuscular connective tissue. This rapidly contracts and approximates the separated muscle ends, so that

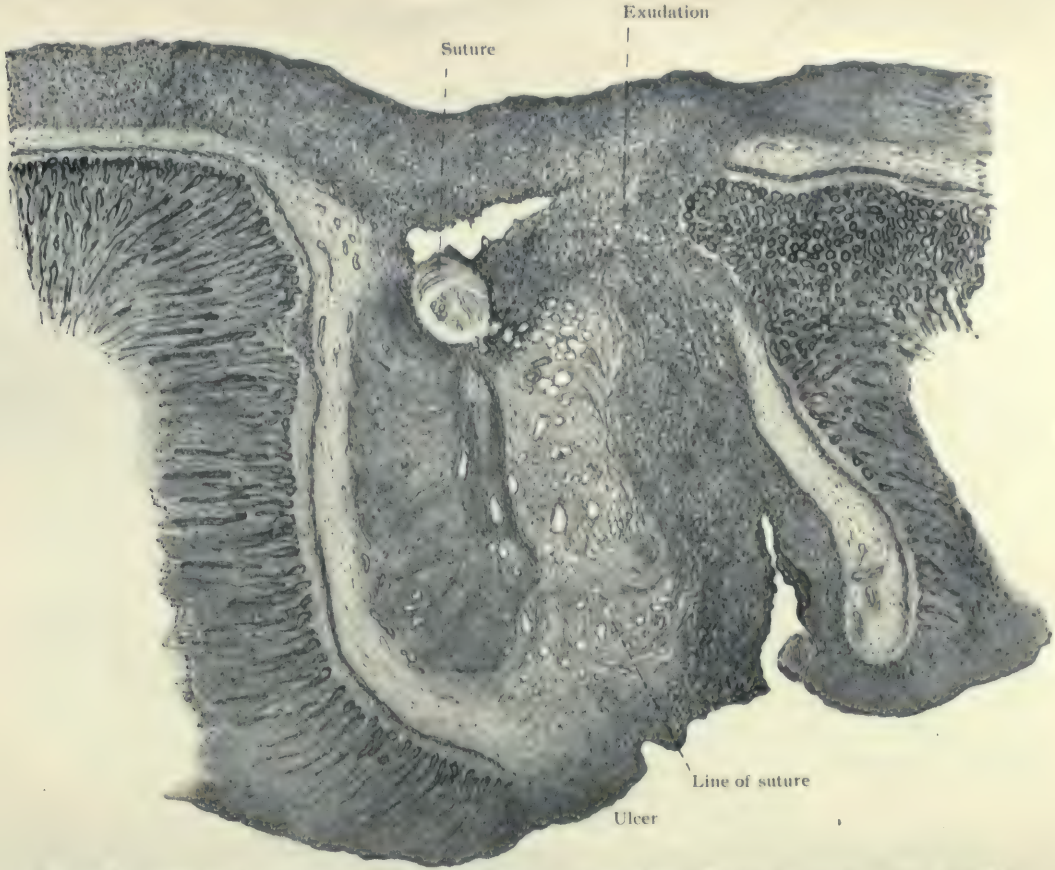


FIG. 7.—End-to-end anastomosis, three days. Note ulcer over inturned edges. Glands of mucous membrane on either side of ulcer necrotic and infiltrated.

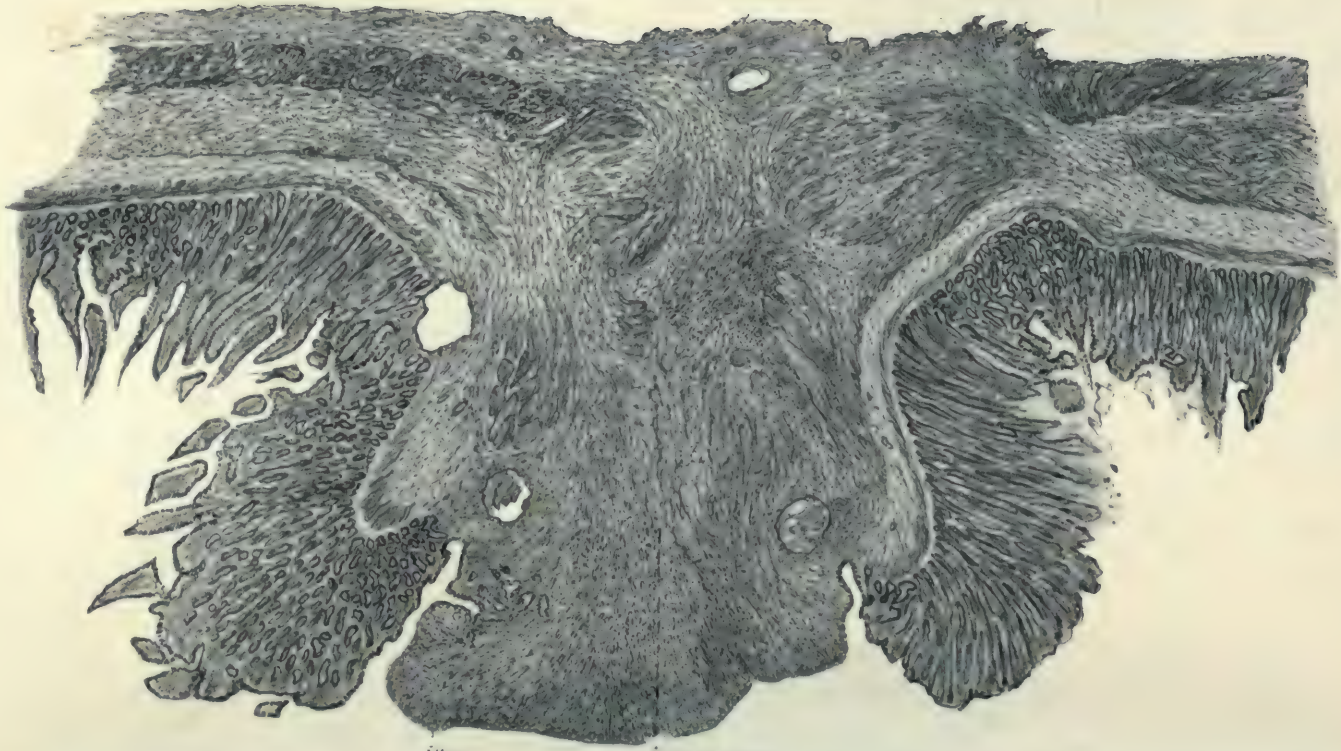


FIG. 8.—Lateral intestinal anastomosis, five days. Exudation almost entirely organized. Ulcer of denser fibrous tissue, new formation of mucous glands at margin.

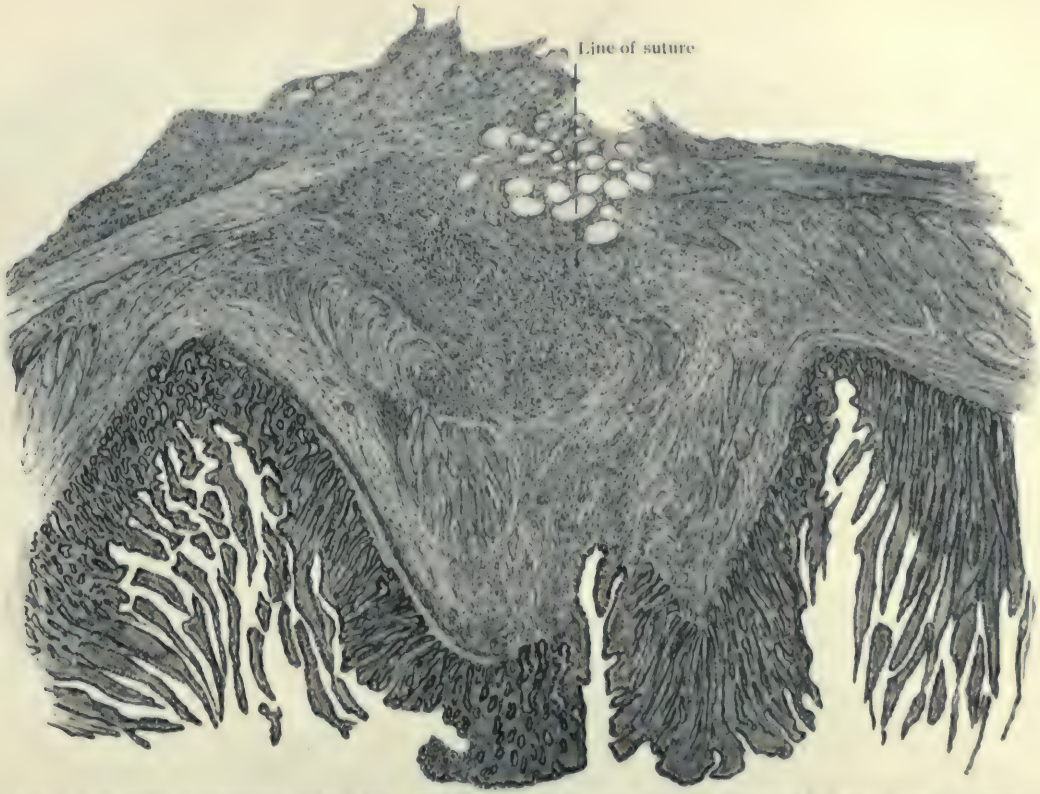


FIG. 9.—End-to-end anastomosis, eight days. Exudation entirely organized. Ulcer covered by newly formed atypical mucous glands.

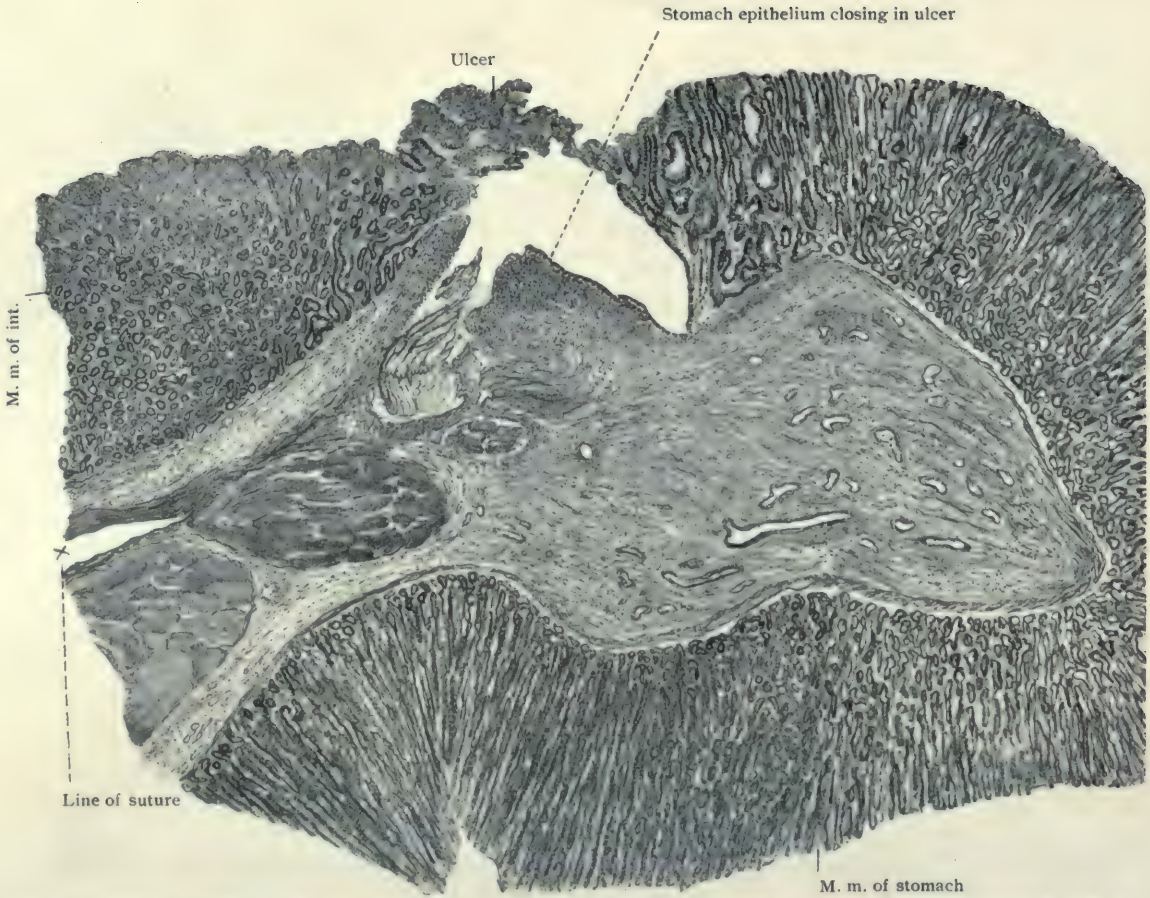


FIG. 10.—Gastro enterostomy, twelve days. Floor of ulcer formed by infiltrated granulation tissue and covered by epithelial cells arising from epithelium of the stomach. Observe that rate of growth of gastric is much more rapid than that of the intestinal epithelium.



FIG. 11.—End-to-end anastomosis, fourteen days. Marked diaphragm. Granulation tissue contracted down to a dense scar. Diaphragm entirely covered by newly formed atypical glands. Marked inequality in the amount of the intestine inverted on the two sides.

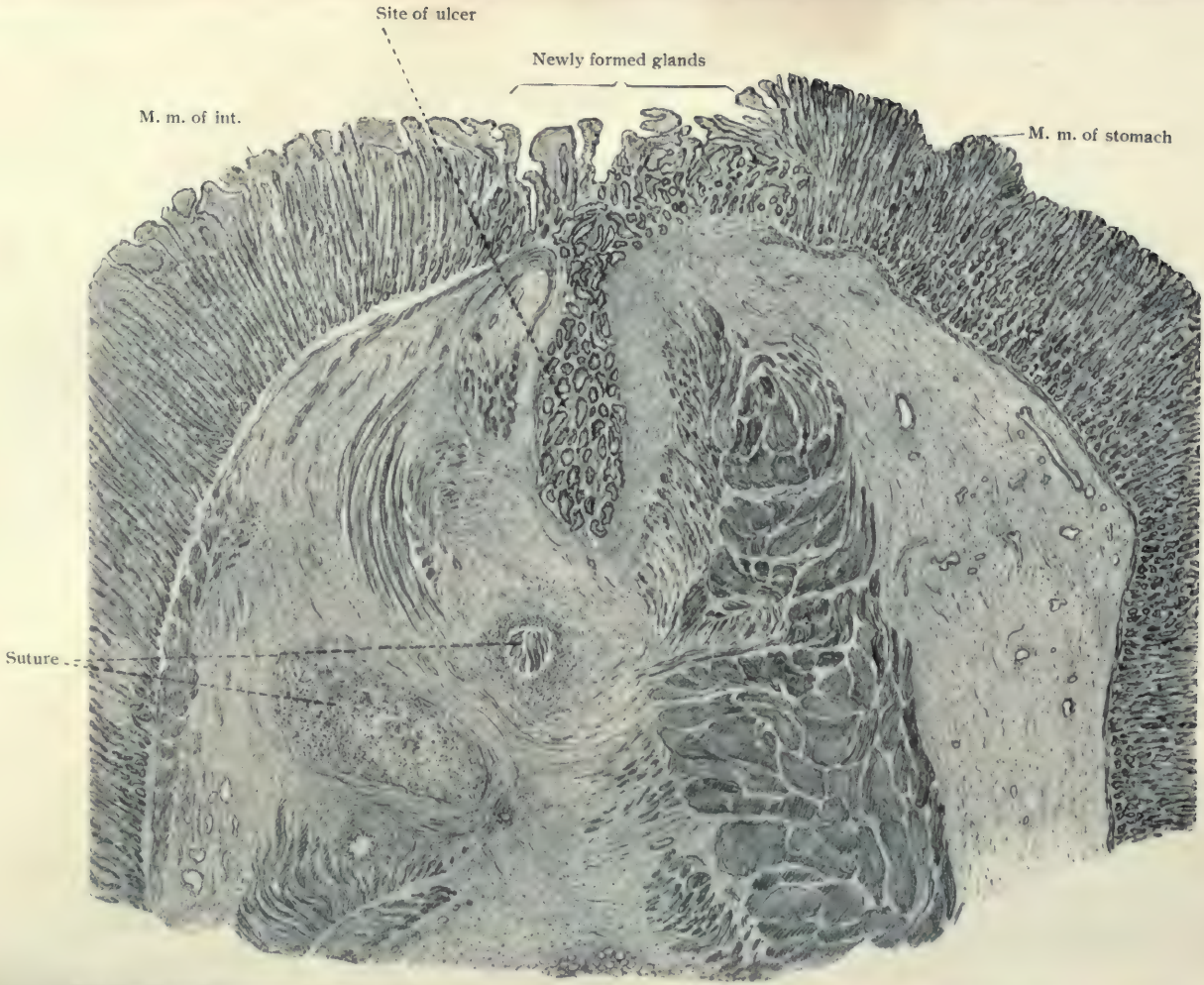


FIG. 12.—Gastro-enterostomy, twenty-one days. Suture held together by dense fibrous tissue, except at the edges, which are covered on both sides with new mucous membrane.

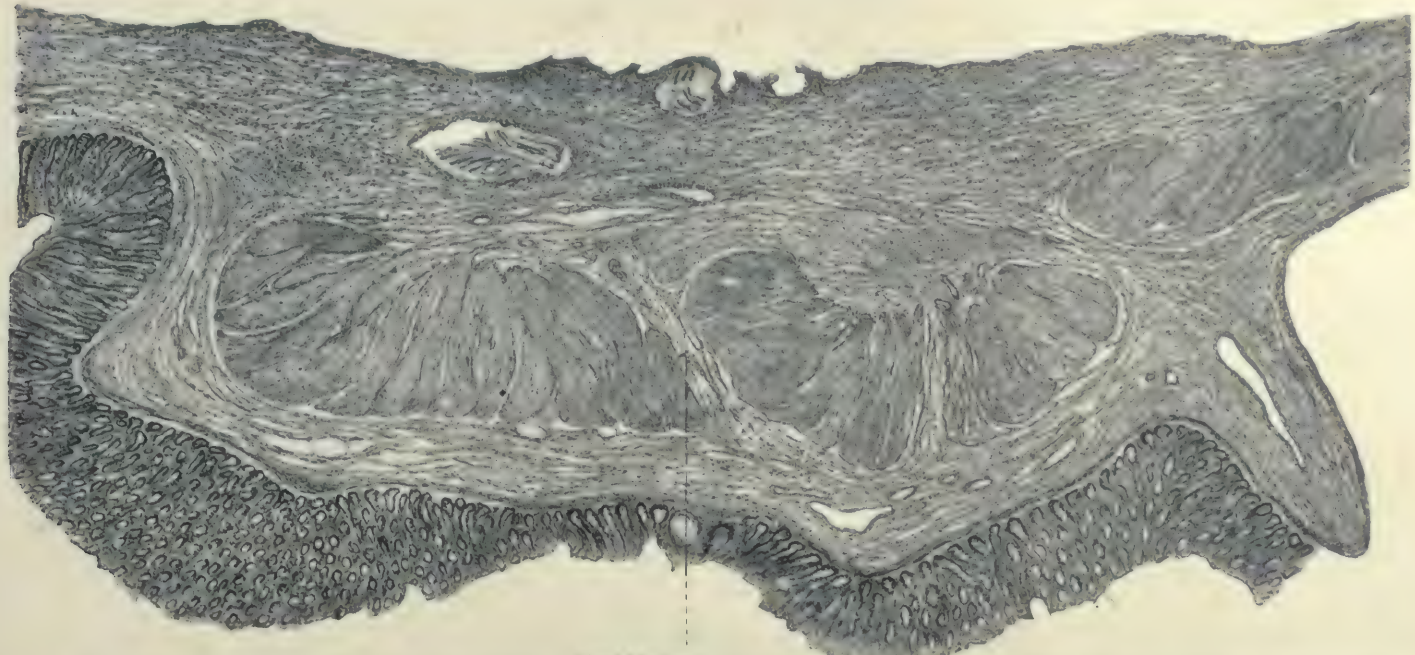


FIG. 13.—End-to-end anastomosis of large intestine, six weeks. The scar is reduced to a thin fibrous line. Inner surface entirely covered with newly formed atypical mucous membrane, thick subserous scar formation (external callus).

the ultimate scar is an extremely narrow one and may be entirely unrecognizable by the naked eye.

Repair of the Submucossa. The loose texture of the submucosa allows easy entrance to the exudate. Almost at once this layer becomes distended and œdematous for several centimetres on either side of the wound. At the end of the inturned bowel this layer is often as thick as all the others combined. As organization proceeds, the submucosa is filled with large and small blood-vessels and young connective-tissue cells, which grow parallel to the surface of the bowel out into the exudate in the bottom of the ulcer, thus forming the base of the internal ulcer. Ultimately the ulcer is converted into scar tissue and is covered by an atypical mucous membrane. From comparison with a limited number of clinically successful intestinal anastomoses in human beings, it seems that the analogy of the process in these animal experiments and in human beings is a very close one, both in histological and in gross appearances.

Advantages of the Ring.—1. Speed. A complete resection and suture can be easily done in fifteen minutes.

2. Cleanliness. Assisted by the clamps, the purse-string suture prevents even a mucous ooze while the continuous stitch is being placed.

3. An intestinal suture is more easily done over the ring than without it.

4. It is safe to use a single layer of continuous stitches, since the ring allows a perfect approximation to be made, and afterwards protects the suture until adhesions have formed.

5. The handle is very useful for holding the intestines in convenient positions for suture.

6. It is not necessary to sew up in layers, since a study of specimens from animals and human beings shows that the mucous membrane will slough in any case, and that repair is more rapid when the mucous membrane is not sutured.

7. The presence of the ring guarantees a free opening at the site of operation.

8. In case the continuous stitch should be improperly applied, the weak spots are protected by the ring itself for at least three days, until the ring breaks down. This allows strong adhesions to form.

9. After operation the ring holds the suture immovable and acts like a splint. The weights of the individual segments of the ring vary from ten to thirty grains, according to size. This is in marked contrast to most other appliances of a similar nature.

Disadvantages of the Ring.—1. General objections to mechanical contrivances.

2. General objections to one layer of sutures.

3. Too large a ring may cause sloughing of the suture from pressure.

4. A foreign body in the intestine is always a source of some danger.

REPORT OF CLINICAL CASES.

CASE I.—*Diagnosis.*—Cancer of pylorus. *Operation.*—Anterior gastro-enterostomy. *Remarks.*—Done at the Massachusetts General Hospital. Recovery after operation.

CASE II.—*Diagnosis.*—Cancer of pylorus. *Operation.*—Anterior gastro-enterostomy. *Remarks.*—Done at Massachusetts General Hospital. Death on tenth day from kink found at suture. Suture intact at autopsy.

CASE III.—*Diagnosis.*—Cancer of pylorus. *Operation.*—Posterior gastro-enterostomy. *Remarks.*—Case of Dr. G. H. Gray, of Lynn. Recovery from operation.

CASE IV.—*Diagnosis.*—Chronic pancreatitis; chronic sinuses leading into colon and stomach. *Operation.*—Posterior gastro-enterostomy. *Remarks.*—Done at Massachusetts General Hospital. Death on seventh day from cachexia, though food was taken at once by mouth and digested. Suture intact at autopsy. Three pieces of ring in ileum, one had passed out.

CASE V.—*Diagnosis.*—Gall-stone attacks and uncontrollable vomiting. *Operation.*—Posterior gastro-enterostomy. *Remarks.*

—Case of Dr. J. W. Spooner, of Hingham. Stomach found contracted to size of intestine and displaced down to umbilicus. Death in three days from uncontrollable vomiting. No autopsy permitted.

CASE VI.—*Diagnosis.*—Cancer of common duct. *Operation.*—Cholecystenterostomy. *Remarks.*—Case of Dr. Philip Mooney, of Gloucester. Recovery. Lived several months.

CASE VII.—*Diagnosis.*—Irreducible intussusception. *Operation.*—Lateral anastomosis. *Remarks.*—Done at Massachusetts General Hospital. Death in a few hours. Suture intact at autopsy.

CASE VIII.—*Diagnosis.*—Intestinal obstruction from cancer of cæcum. *Operation.*—Lateral anastomosis. *Remarks.*—Done at Massachusetts General Hospital. Immediate feeding. Rapid recovery. In good health after several months.

CASE IX.—*Diagnosis.*—Megacolon. *Operation.*—Resection, end-to-end anastomosis. *Remarks.*—Done at Massachusetts General Hospital. Immediate recovery. Later abscess about suture (three weeks). Suture intact. Abscess cavity healed by granulation. One segment passed by rectum three months after operation.

CONCLUSIONS.

1. The process of repair is as rapid after use of the segmented ring as after a plain suture.

2. The time required for the operation is, on the whole, less than that required for a straight intestinal suture.

3. Certain objections, such as weight, ulcer, difficulty of passage, etc., inherent in other mechanical contrivances, are minimized by the ring.

4. The analogy between the experimental and the human observations is so close as to show the propriety of the deductions made from the animal experiments.

5. The employment of the ring in human beings is safe and satisfactory for all sutures.

Many thanks are due to Dr. E. H. Nichols, Director of

the Surgical Laboratory of the Harvard Medical School, for valuable suggestions.

The drawings which accompany this article were made by Miss Florence Byrnes.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting, May 25, 1904.

The President, HOWARD LILIENTHAL, M.D., in the Chair.

TETANUS (ACUTE) CURED BY INTRANEURAL AND INTRASPINAL INJECTIONS OF ANTITOXIN.

DR. JOHN ROGERS, JR., presented a boy, ten years of age, who on April 25, 1904, stepped on a rusty nail, inflicting a wound in the sole of the right foot. The injury was regarded as unimportant, and was not treated by a physician. On the morning of May 2, the boy complained of a stiff neck and back, and experienced a choking sensation. When he was brought to the hospital, at ten o'clock that morning, there was trismus and *risus sardonicus*. An hour after his admission, the patient was given twenty cubic centimetres of tetanus antitoxin subcutaneously in the lumbar region, and at two o'clock in the afternoon a second dose was similarly administered.

The next morning, May 3, there was distinct opisthotonus, rigid jaws, and every indication of acute tetanus. This subcutaneous dosage had not the least effect. The patient was now transferred to Dr. Rogers's care, and at 11 A.M., under chloroform anæsthesia, he exposed the anterior crural and sciatic nerves on the right side, and injected into each about half a drachm of the tetanus antitoxin prepared by the New York Health Department. At the same time, through a lumbar puncture, he injected a drachm and one-half of the antitoxin directly into the cord, working the point of the needle around until the patient's legs were observed to twitch; in other words, intentionally wounding one or more of the nerves of the cauda equina.

On the following morning, May 4, the boy was a little worse. He had had four convulsions during the night, each lasting about ten minutes. The opisthotonus was very marked, the patient was weak and cyanotic, and his condition was extremely bad. The case, apparently, was hopeless. He was again chloroformed, and through a long needle a drachm and one-half of antitoxin was injected into the spinal cord between the second and third dorsal vertebræ. That night he had no convulsions and slept quietly, and the following morning he was able to open his jaws a little. He was also less rigid, and the cyanosis had disappeared. On Friday he was not quite so well. He had had no further convulsions, however, but his jaws were more tightly closed and the rigidity was more marked than on the previous day. He claimed, however, that he felt better. Another injection of a drachm and a half was made by lumbar puncture, and the point of the needle worked back and forth in the substance of the cauda equina. This procedure produced some hæmorrhage from the cord, but there were no ill effects. The patient passed a good night, and on the following day, although he was able to separate his jaws fully a quarter of an inch, another injection was made in the lumbar region as a precautionary measure. His further recovery was uneventful, with the exception of a severe, bluish-red dermatitis which developed on May 9; this involved the trunk and legs, and gradually subsided.

In addition to the above treatment, the initial wound on the sole of the foot was opened and swabbed with tincture of iodine. Pure cultures of the tetanus bacilli were obtained from the secretions of this wound, as reported by Dr. L. Smith, bacteriologist at the Cornell Medical College. The increase in the severity of the symptoms on the second day was probably the result of failure to expose the obturator nerve and inject it with antitoxin as well as the sciatic and anterior crural. The obturator nerve was forgotten, and its charge of toxin was not stopped from entering the cord.

Dr. Lilienthal said he understood that the remedy used by Dr. Rogers was a true tetanus antitoxin, and he raised the question as to whether an antiseptic of any form, for example, lysol, which had been used in cerebrospinal meningitis with marvellous results, might not be worth trying in case the antitoxin was not obtainable.

Dr. Rogers, in reply to a question, said the injections into the anterior crural and sciatic nerves were made directly into the substance of the nerve, so that they swelled up to about the size of the finger. He stated that prophylactic injections of the antitoxin had been reported by several authorities, apparently with good results. Experimental investigations had shown that the tetanus poison was carried through the muscle end of the nerve apparatus; it could only travel in the motor nerves and in a centripetal direction, and the length of time it took to reach the cord was proportionate to the length of the nerve it had to traverse. On this theory, a prophylactic dose of the antitoxin could be given so as to reach the cord before the toxin.

Dr. Rogers said that various antiseptics had been tried more or less unsuccessfully in the treatment of tetanus, although none of them, so far as he knew, had been injected directly into the nerve tissue. The tetanus antitoxin, as prepared by the New York Health Department, was preserved by chloretone; but the percentage of this antiseptic was so small that it probably played no part in the curative action of the antitoxin.

Dr. Charles H. Peck said the case shown by Dr. Rogers represented a type of tetanus that usually ended fatally, and the result in this instance was certainly very gratifying. In the case shown by Dr. Rogers a month ago, where recovery had followed the same method of treatment, the symptoms had not been so severe. The speaker asked Dr. Rogers if he would select the facial nerve for injection in a case where the point of infection was on the head or face.

Dr. Rogers said he thought it would be entirely feasible, in such a case, to inject the antitoxin into the facial nerve in the region of the parotid, and at the same time into the cervical cord. The mode of death from tetanus was by tetanic spasm of the respiratory centre ,which was some little distance from that of the facial nerve. The speaker said that in a case of cephalic tetanus he would not hesitate to inject the antitoxin directly into the cervical cord.

REMARKS ON APPENDICITIS BASED ON AN ANALYSIS OF 219 CASES.

Dr. Parker Syms read a paper with the above title, for which see page 727.

Dr. Lilienthal said he was in thorough accord with the statements made by Dr. Syms. Even if the results of Dr. Ochsner's series of cases treated by the starvation method were remarkable, it did not follow, in the speaker's opinion, that the method was a proper or surgical one. The more he saw of appendicitis, the more thoroughly convinced he was that it was an operative condition whenever the diagnosis could be made. The same rule that Dr. Syms carried out at Lebanon Hospital was also followed by Dr. Lilienthal at Mount Sinai. In cases where the symptoms were evidently receding at the time of the patient's admission to the hospital, an operation was occasionally delayed from hour to hour, but the operation was never postponed, in the hope that the symptoms might recede. An operation was considered much safer than the starvation or any other method.

Dr. Lilienthal said that on his Surgical Division at Mount Sinai he, together with the Adjunct Surgeons, Drs. Elsberg and Wiener, had operated on 455 cases of appendicitis since 1899, with a general average mortality of 10 per cent. During 1902–3 they had operated on 140 cases, with nine deaths, a little over 6 per cent. Of these 140, about thirty-eight were interval cases and the others were acute, and often desperate. The speaker said that was the way in which he divided his cases. He did not quite agree with the division made by the reader of the paper of the cases of general and diffuse peritonitis, for this reason: A general peritonitis might be of a comparatively mild and aseptic type. A tuberculous peritonitis, for example, might be general in character and still not prove fatal. So it was with a streptococcus or staphylococcus peritonitis, or one due to some other pathogenic organism. It was not so much whether the peritonitis was general, or merely diffuse, and not perhaps involving every part of the peritoneum, as it was the character of the infection, and the idiosyncrasy of the individual who was diseased. Some persons could not withstand infection well, perhaps dying from a local peritonitis, while others did not succumb to very severe and almost fulminant forms of peritoneal infection.

Dr. Syms, in his paper, made the statement that every death after operation for appendicitis was a public calamity. Perhaps it was just as well, Dr. Lilienthal said, to put this the other way, and say that every case of appendicitis that got well without an

operation was a public calamity, because such cases induced the public to believe that an operation was unnecessary, and lulled them into a sense of false security.

Dr. George D. Stewart said that in his work at Bellevue and St. Vincent Hospitals he had been treating cases of appendicitis along the same lines as those followed by Dr. Syms, and that the series of cases reported by Dr. Ochsner had not induced him to change his method. Various so-called conservative methods of treating appendicitis had been advocated from time to time, but the speaker said he was in entire accord with those who looked upon it as a surgical condition. Not long ago, a medical man in the French army proved by the statistics of an enormous number of cases of appendicitis that better results were obtained by medical than by surgical treatment. Such statistics, however, were practically of little value.

Not long ago, Dr. Stewart said, a certain surgeon in this city had reported a number of cases of general peritonitis following appendicitis upon which he had operated, with no mortality. Such results were rather surprising, and raised some doubt as to the correctness of the diagnosis. It was well known that general peritonitis in appendicitis was really very rare, owing to the peculiar anatomical relations of the parts. A collection of pus might fill the pelvis and run up the right side of the abdomen as far as the liver, but the cæcum, the ascending colon, and a wedge of greater omentum acted as a natural barrier and prevented it from spreading to the left side. Even through a wide incision such a condition might appear to the operator to be one of general peritonitis, so far as could be told, while as a matter of fact the infection might not have involved the left side of the abdomen at all.

Dr. Stewart said that his rule in dealing with appendicitis was as follows: If the case was a severe one, operate at once. If it was a mild one and not getting worse, watch it carefully for a short time; if it gets worse, operate; if the symptoms remain stationary, do not delay the operation too long. In other words, he advised operation in every case unless the symptoms were distinctly improving when the patient came under his care.

Dr. Rogers said that most of the surgeons in this city were probably in close accord with the views expressed by Dr. Syms and those who had discussed his paper. The only difference of

opinion that might exist was in reference to the use of drainage. He had observed that the younger surgeons were much more inclined to dispense with drainage than the older men.

Dr. Benjamin T. Tilton said that his rule in operating for appendicitis was practically the same as that outlined by Dr. Stewart. As regards drainage of the abscess cavity, he now favored the use of a small wick, or a piece of rubber tissue, in preference to extensive packing, which plugged the cavity and necessitated a painful after-dressing. As far as flushing was concerned, he thought it should be avoided excepting when the exudate was limited to the pelvis.

As regards the proper time to operate, Dr. Tilton said he thought an early operation was always advisable unless the patient was undoubtedly going on to recovery. In cases of abscess formation, simply opening the abscess was in many instances the safest procedure. The speaker said he could recall a number of cases where this was done and there was absolutely no return of the trouble. It was ofttimes undoubtedly a life-saving measure, and he thought it should be more commonly done, especially in cases where the surgeon was called in to operate under inopportune circumstances.

Dr. John A. Hartwell said that in suppurative cases of appendicitis the starvation method of treatment recommended by Dr. Ochsner might prove valuable after operation. In such cases, where the feeding was done per rectum and the patient was only given a little ice by the mouth, the speaker said he had been struck by the lack of abdominal distention, and the more rapid subsidence of all the acute symptoms.

Dr. Peck said that in cases of appendicitis with abscess formation, especially in the retrocæcal type of abscess, where the appendix was often destroyed, it was well, he thought, to follow the suggestion made by Dr. Tilton, and simply open the abscess, in those cases where the appendix could not be easily shelled out. The rest of the peritoneal cavity should be walled off and protected before opening the abscess. When there was no well-defined abscess and the appendix was buried in a mass of recent adhesions, the speaker said he depended a good deal on the sense of touch in delivering the appendix, and did not, as a rule, wall off the field with pads. The operative field could then be cleaned by either sponging or flushing. In cases where the exudate was

spread out over a wide area, the cleansing could be done with less trauma by flushing than by swabbing.

Dr. Peck said it was often difficult to distinguish between a diffuse and a general peritonitis. Recovery was not infrequent after a peritonitis involving the entire pelvis and right side of the abdomen. The entire abdomen, as Dr. Stewart said, was comparatively rarely involved in the process.

The speaker said he favored the use of a small drain down to stump or in abscess cavity. He was becoming convinced of the fact that a small drain was equally if not more effective than a large mass of gauze.

Dr. John D. Rushmore said that in many cases of appendicitis the surgeon had no choice as to the time of operation. The family physician was usually first called, and if, after three or four days' treatment by various methods, the symptoms became aggravated or were not relieved, the surgeon was sent for and had to accept the situation as he found it. Personally, Dr. Rushmore said, he believed in operating early: he considered the risk of waiting to be infinitely greater than that of operating. It would prove a valuable object lesson to the physician to witness more of these operations, and see how far advanced the condition was before surgical aid was invoked. Many physicians, apparently, fail to recognize a tumor in the abdomen, even after it has become quite perceptible to the surgeon.

The onset of an attack of appendicitis was usually figured from the time when the pain begins, and this Dr. Rushmore thought was a grave error. The actual onset of the disease in many cases probably antedated the pain by days, and perhaps weeks. He compared the changes that took place in the appendix in appendicitis to those that occurred in the small intestine in typhoid fever. In an attack of typhoid fever, no one would be able to locate an ulcer of the intestine, although present for many days, and it would be manifestly improper, when rupture occurs, to call that day the first day of the disease. In appendicitis we have an analogous condition.

It was not unusual to see a case of appendicitis run its course, and then, after the patient had apparently recovered, and all the symptoms had abated, to find, on operation, a deep ulcer of the appendix on the point of rupturing. These conditions occurred as the result of the so-called conservative or expectant treatment,

and many of them after the starvation method had been employed for three or four days. The speaker recalled a case upon which he had operated recently, where the only symptom was abdominal tenderness. The pulse was 72, the temperature normal; there was no tension; no tumor. Still, upon operation, the mucous membrane of the appendix was found to be gangrenous from the root nearly to the tip. The so-called interval cases of appendicitis were frequently found not to be interval cases at all; the appendix was found to be kinked or strictured or ulcerated.

Dr. Syms said there was a smouldering tendency on the part of many physicians to seek some excuse for delaying operative interference in appendicitis. In 1901, at a meeting of the Surgical Section of the American Medical Association, no less an authority than Dr. Senn, of Chicago, made the assertion that there was entirely too much operating in appendicitis, and stated that 20 per cent. of all cases of appendicitis would recover without an operation. This statement was met by a storm of applause, which showed the strong sympathy with such dangerous views even in a surgical gathering of that kind, and it was not until the surgeons had rallied, and Dr. John B. Murphy, of Chicago, had called attention to the fact that Dr. Senn's statement implied a terrible mortality of 20 per cent. without operation, that the meeting came to its senses, and realized that no statistics could be based on the number of recoveries without operation. A single patient may have recovered from ten or a dozen attacks of appendicitis, and these recoveries may figure in various statistics, but without operation, such a case may go on to inevitable mortality. Ochsner compared his series of cases treated by the expectant method with a similar number treated by Deaver by operation, and showed that, according to his figures, his results were better than those of Deaver. His conclusions, however, were open to the objection that in Deaver's cases the exact condition was actually observed, while in his own it was not. Surgery discloses the exact condition present at the time of operation.

Some years ago, Dr. Syms said, he wrote a paper on this subject, entitled, "When to Operate," in which he attempted to classify the cases that would recover without operation, and which could be safely treated expectantly, and those that would require operation. To-day he had come to the conclusion that there was only one thing to do when the diagnosis was made, and that was

to operate. This rule might be modified, perhaps, under special conditions, but not otherwise. Given an acute inflammatory condition in the abdomen, there was only one way to ascertain its extent and seriousness, and that was to operate. In no other way could the exact condition of affairs be learned.

Dr. Rushmore said he did not think that statistics comparing medical and surgical cases of appendicitis were of much practical value. The cases that recovered under the starvation method were probably picked cases. The only proper comparison between medical and surgical statistics is afforded by having a certain number of cases treated from start to finish by the physician and the surgeon, and not to have the cases turned over to the surgeon after the ideal time for operation has passed. And we must also remember that barring those few cases of appendicitis terminating in suppuration and that open into the intestines, bladder, etc., if the surgeon did not interfere, the case would almost always terminate fatally, and would be fairly counted as a medical death.

Dr. Syms called attention to the fact that all of Dr. Ochsner's cases were subsequently operated on.

Dr. Lilienthal said that in spite of that fact they were picked cases, and if they had gotten worse under the starvation method of treatment, they would probably have been operated on without delay.

REVIEWS OF BOOKS.

LEHRBUCH DER SPECIELLEN CHIRURGIE FÜR AERZTE UND STUDIRENDE. Von DR. FRANZ KÖNIG, Berlin. Achte Auflage. I and II Band. Berlin: Verlag von August Hirschwald, 1904.

Four years have elapsed since the sixth edition of this extensive treatise on Surgery made its appearance, and for the first time the first and second volumes are published in the same year. This has been made possible by the aid of Professor König's son, Professor Fritz König, in Altona, who has co-operated with his father in the production of the second volume. The third volume is promised for the latter part of this year.

Volume I treats of the surgical diseases of the Head, Face, and Neck. It contains 803 pages of text. The changes to be noted in this volume are comparatively few. The volume might be improved by the addition of up-to-date illustrations and a good index.

Volume II, containing 941 pages, is devoted to the Surgery of the Thorax, Abdomen, and the Male Genito-Urinary Tract. The revision of this volume has been much more extensive than that of the first volume, although the American surgical teachings seem to find very little place even here. The chapters on Peritonitis and Intestinal Resection have been revised, but some of the more recent American operations are not mentioned. The chapters on Abdominal Tumors and Surgical Diseases of the Male Genito-Urinary Tract have been thoroughly revised.

Dr. Nitze has written the section on Cystoscopy.

Dr. König's Surgery has long been recognized as one of the standard German works, and it may be described as practical, systematic, and complete.

PAUL M. PILCHER.

Éléments de Pathologie et de Clinique Chirurgicales. Par le Dr. Leon Moynac, Ancien interne des hôpitaux de Paris, etc. Eighth Edition. Three volumes. Pp. 2000. Illustrated. Paris: G. Steinheil, 1903.

Under this title Dr. Moynac presents the eighth edition of a work that has had a steady circulation as a text-book for students in France. As the title indicates, the work endeavors to place before the reader in a concise manner the clinical aspect of surgical affections, together with the general and special pathology of each.

The broad principles of surgery and pathology, as accepted by recognized authorities to-day, are presented first in a clear and comprehensible manner, including the fundamentals of asepsis and antisepsis. Then follow the surgical diseases, and, lastly, the injuries, neoplasms, etc., arranged anatomically. The author covers not only the ground assigned to the general surgeon, but also devotes considerable space to the special branches, as the eye, ear, and nose.

Altogether, the three volumes, in arrangement, size, and material, constitute an acceptable addition to the working library of either practitioner or student.

Henry Goodwin Webster.

Radiography and Phototherapy, including Radium and High-Frequency Currents. By Charles W. Allen, M.D., New York. New York and Philadelphia: Lea Brothers & Co., 1904.

The present volume is the product of three men,—Dr. Allen, who is Professor of Dermatology in the New York Post-Graduate Medical School; Milton Franklin, M.D., of the New York Polyclinic Medical School, and Samuel Stern, M.D., Radiotherapist to Dr. Lustgarten's clinic at the Mount Sinai Hospital.

At the present time, when the subject of radiant energy is

engaging the attention of so many investigators throughout the world, the publication of the present volume is very welcome.

In Dr. Allen's book the practical and technical side of radiography has been briefly treated, and there has been more space given to the therapeutic effects. Elementary electrophysics and shadow pictures have been omitted, and the subjects of Radio-activity and High-Frequency Currents are considered at length.

As the science advances and our experience broadens, we are able to state in more exact terms what the dosage of a therapeutic agent should be, and this, as shown by the author, is equally true in this branch of therapeutics.

The volume is divided into seven parts,—General Consideration upon Radiology, Diagnosis, Radiotherapy, Light, Actinotherapy, Radio-activity, and High-Frequency Currents.

The first few sections present nothing especially new, while the chapters on Radio-activity and High-Frequency Currents are very interesting and instructive. The book will find its greatest usefulness in the hands of those who have already mastered the elements of the science.

PAUL M. PILCHER.

MEDICAL DIAGNOSIS: A PRACTICAL TREATISE FOR STUDENTS AND PRACTITIONERS. By JOHN H. MUSSER, M.D., Professor of Clinical Medicine in the University of Pennsylvania, etc. Fifth Edition. Pp. 1213; fully illustrated in colors. Philadelphia: Lea Brothers & Co., 1904.

There may properly be some difference of opinion as to the form which a treatise on diagnosis should take. One may justly claim that between the covers of such a book should be found everything which can bear upon every form of disease, but in the arrangement of this material lies its real value. The student will look for the logical development from the single symptom to the group that characterizes the disease, and the comparison that distinguishes similar groups. He may expect greater detail and a

more discoursive treatment, the analysis of individual symptoms in their relation to the entire complex, and the discussion of the relative value of each. Such a treatment of the subject is eminently scientific and scholarly, but it tends rather towards the Practice of Medicine than Diagnostics. Those who turn most eagerly to a book of reference are the puzzled practitioners who have no time for deliberate study, and welcome a system that makes it possible, by the consideration of a few cardinal symptoms, to apply their already acquired technique in the briefest time and with the least exertion.

Just how far laboratory methods should enter into general practice must rest with each practitioner. There can be no question of the desirability of routine examination of all the available secretions, but this requires time to do properly and skill to execute, and unless painstaking, deliberate, and accurate, such examinations are more than useless. The younger generation is being taught all this, and in time it will be possible for every physician, if not already himself equipped, to call to his aid some one who is.

Turning from such general considerations to the consideration of "Medical Diagnosis," one is first of all impressed with the vast amount of material here accumulated, and the evidences of painstaking care in its classification and arrangement. We are assured that the entire book has been rewritten and rearranged along the lines that one would naturally employ in taking a history, and that the illustrations have been doubled.

Of the 1213 pages, 700 are devoted to the methods and instruments of diagnosis, 482 to the diagnosis of special diseases, and 31 to a good index. Nine pages, including six plates, four of them skiagraphs, are devoted to the Röntgen ray in medical diagnosis. The chapter is eminently suggestive and helpful. It would be impossible to specify each point of excellence without reproducing the entire book; but in glancing here and there one is struck with many desirable innovations, such as the table of

graphic symbols used in representing the phenomena of physical examination.

If adverse criticism is permissible on so excellent a work, it may be said that, in spite of the rearrangement of the contents, there is still a lack of compactness, a tendency to amplification both in text and illustration that makes a cumbersome volume and hampers ready reference. Additional cross references would be desirable. Judicious compression would improve it.

HENRY GOODWIN WEBSTER.

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ORIGINAL MEMOIRS.

ON THE MORPHOLOGY OF CARCINOMA AND THE PARASITIC THEORY OF ITS ETIOLOGY.[1]

BY GEHEIM-MEDIZINALRATH PROFESSOR DOCTOR JOHANNES ORTH,

OF BERLIN,

Professor of Pathology in the University of Berlin.

(Translated from the German of the author's manuscript by PAUL MONROE PILCHER, M.D.)

IN complying with the urgent invitation with which I have been honored, I accept the subject of Carcinomatous New Growths as the theme of an address. I cannot offer anything that is new, but it may, however, be of certain interest to hear the views of a pathologist who believes himself to be essentially in accord with the majority of German pathologists concerning two fundamental questions, which are as follows:

I. In what way is cancer morphologically characterized?

II. What can be said concerning the parasitic origin of the disease?

I. With regard to all that the first question involves, there can be no doubt that the characteristic and distinguishing features of the cancer cells are that they are none other than epi-

[1] Read before the Surgical Section of the International Congress of Arts and Sciences, St. Louis, September 23, 1904.

thelial cells. They are epithelial cells not only in accordance with their structure, with respect to the nature of their protoplasm and nuclei, not only epithelium in accordance with their biological activities, but they are also epithelium in accordance with their origin.

There is no metaplasia from connective-tissue cells or cells of that nature into epithelial cells, into cancer cells; it is true that one kind of epithelium can be transformed into another kind, for example, cylindrical cells into squamous cells, squamous cells into cylindrical cells, but an epithelial cell can never be made from a connective-tissue cell, and, *vice versa,* a connective-tissue cell can never be transformed into an epithelial cell.

However, in primary cancer it is difficult to prove the direct derivation of cancer cells from preformed epithelium, for the growth of a cancer is one thing, and its first inception is another. I am, I confess, of the opinion that there are cancers in which the transformation of preformed epithelial cells into cancer cells takes place continuously in the tissue bordering upon the margin of primary tumors, also that there are multicentric cancers, not only in the sense that the cancer change takes place at the same time in different neighboring spots, but also in such a manner that one spot becomes cancerous later than another. However, at the same time, I recognize that many cancers are unicentric, that they have arisen from a single-cell complex only, and possess only an interstitial but no contiguous growth. Formerly, a transformation of preformed epithelium into cancer was generally accepted without further investigation, as soon as a connection between such epithelium and cancer cells was present. That an assumption of this kind is not admissible, Ribbert has justly called attention to, since it is possible for cancerous epithelium to grow somewhere near preformed epithelium and become secondarily annexed to it. One dare not go so far, however, as to attempt to explain in this manner every connection between cancer cells and normal epithelium which one finds on the border or in the immediate neighborhood of a cancer; for by means of serial sections one

can often clearly demonstrate that an isolated deep growth of preformed cells appears, in which, while they closely resemble the mother cells, there is visible at the same time a certain difference. That thereby a particular kind of karyomitosa may be detected similar to the mitosis of the fertilized egg, concerning which I am not as yet entirely convinced, but undoubtedly in connection with this, changes in the condition of cells in regard to pigment do present themselves, as is most easily demonstrated in cancers of the gastro-intestinal tract. Not every appearance of growth in preformed epithelium can be regarded as the beginning of a cancerous change, for there is to be found on the border and in the neighborhood of cancer, just as of other rapidly growing tumors, a multiplication of cells as well as the formation of glycogen, which are only expressions of purely hyperplastic processes; but if a distinct plug-like ingrowth into the underlying tissue with a change of the cell body can be demonstrated, then one can consider it a primary cancerous change.

The origin of cancer cells from preformed epithelium can be recognized with most certainty in the very young cancers, and for this reason the work of Dr. Bormann, Ribbert's assistant, in collecting and carefully examining such cases, was most important. In his work which appeared recently he produces proof for the epithelial origin of the cancer cells in very young primary cancers.

A strong support for the conclusion that all cancer cells originate in regular succession (by inheritance) from preformed epithelium is supported by the secondary cancers of this kind, for they demonstrate, by the innumerable mitoses which the cancer cells show, how vigorously these multiply, so vigorously that the entire growth of these secondary growths can in this way be entirely explained. They demonstrate in the beginning, by the appearance of the first cancer cells in the lymph spaces of the lymphatic glands, by the presence of cancer cells in blood-vessels, that detached cancer cells represent the foundation, the starting-point of new cancerous nodules. It can always be shown by investigation of serial sections, especially

in embolic formation of cancers in the lung or in the liver, that a cancerous exuberant growth in the neighborhood of the vessels always takes its exit from a cancerous growth through the wall. There is no contact infection by way of the tissue surrounding the vessel through the intact wall of the vessel; but a continuous connection between the embolus and the perivascular cancer is always present; the embolus has by uninterrupted increase of its cells grown through the wall into the surrounding tissue.

Of very special importance for the assumption that all the cells of a secondary cancer have arisen from detached cells of an already existing cancer is the suppression of the local cells at the point of the new growth. As one can most easily demonstrate in the case of cancer of the liver, the local cells, the liver cells have nothing at all to do with the new growth of the cancer cells; they remain entirely passive, become displaced by the uninterrupted increase of the cancer cells, atrophy, and finally disappear.

All this goes to prove that the epithelial cancer cells form the essential element of the cancer; but they are not only the most important, but indeed the ONLY important, element. The tissue, other than this which is present in the cancer, the stroma, is without any significance for the organization of the cancer. There can be cancerous new growth without this stroma: in the so-called lymph-vessel cancers, that is to say, exuberant growths of cancer cells in the lumen of the lymph-vessels, which are seen in the lung, uterus, and other places, the lymph spaces, or greatly dilated lymph-vessels, for some distance are filled with cancer cells, without the presence of a trace of stroma. In other cancers the local tissue can take the place of stroma; in this manner cancerous growths are found in the lung in which the alveolar net-work immediately takes the place of the cancer stroma; in intravascular or infiltrating cancer of the liver the liver tissue itself, the liver cells with the interstitial connective tissue, forms the cancer stroma. In other cases the cancer stroma is also a new structure, as illustrated most clearly in many cancers of the ductus thoracicus in which the lumen

of the dilated duct contains not only cancer cells, but also a stroma, which is made up of entirely new-formed tissue, but tissue which has developed from the nearest local tissue, namely, from the wall of the vessel. Professor Williams, of Buffalo, investigated such a case at my institute in Goettingen, in which there were present in the stroma also elastic fibres, whose connection with the elastic tissue of the wall of the duct could be satisfactorily demonstrated.

The conclusion to be drawn from all this is that the stroma is an absolutely non-essential, accessory, and unimportant constituent of the cancer, even though in single instances the stroma may have a certain significance in determining the variety or character of the cancer. That, however, a scirrhus in its essentials (characteristics, organization) does not differ from a medullary, soft cancer is very clearly shown from the fact that the periphery or the metastasis of a scirrhus may be throughout of a softer medullary quality.

If, however, according to what has been said, epithelial cells originating in uninterrupted succession from preformed epithelium are the only essential thing in cancer, then from a scientific stand-point, and in accordance with the customary nomenclature, every cancer must be designated as EPITHELIOMA. In order to differentiate it from other epithelial new growths, it can be designated as malignant, destructive, or as ABERRANT EPITHELIOMA, the distinction being that in cancer epithelial cells are found in localities where epithelium does not normally exist. Where sharp boundary lines exist in an organ between the epithelial and non-epithelial portions, as in the stomach and intestines, it is easy to establish the aberrancy of the cancer cells; in other places it is especially the occurrence of portions of tissue enclosed within the masses of cancer cells, principally of elastic and collogen (collogenen) fibres, which prove that the cancer cells are present in a place where they do not belong, that as a disturbing element they have crowded into the tissue.

A further consequence of the epithelial nature of cancer is this, that the variety of the cancer must be determined by the

special characteristics of the epithelial cancer cells in the particular growth. It is of great significance, therefore, that in every deviation of the cancer cells from the normal epithelium, without exception, in the primary growths as well as in the metastases, there is found to be a definite character in the arrangement and in the morphological as well as the biological character of the cells.

In accordance with this, two groups of aberrant epithelioma may be distinguished:

1. Those with *typical arrangement of the cancer cells.*
2. Those with *atypical arrangement of the cells.*

To the first group belong (*a*) cancers, which follow the glandular type, *adenomata,* built up principally from cylinder cells, which form glandular ducts (canals) and complicated glandular structure, and which not infrequently produce a kind of secretion, especially in the stomach and intestines, a slimy secretion. (*b*) Cancers, whose cells, with respect to form, transformations, and arrangement in strata, are like the *epidermis,* and which for a long time have borne the name *cancroid.* It is of special importance for the theory that all cancer cells of the metastatic growth originate from cells of the primary growth, that just as in this first group of cancer, in the adenomata as well as in cancroids, the cells in the metastases show the same form and the same arrangement or transformation and stratification as those of the corresponding primary growth.

The second group is composed of cancers whose cells are placed together irregularly and in masses and patches (strings, cords, etc.), which therefore show an *atypical arrangement,* whose cells also show fewer distinct peculiarities, of which, however, it can well be said that they differ according to the particular organs in which the parent growth originated. I should like to designate this form of cancer by the word which has for its root the word cancroid, *i.e., cancer.*

There are many varieties of mixed and transitional forms between these main groups.

II. With these points fixed, we already have a good basis

from which to consider the second question proposed for discussion, *i.e.*, the possible parasitic origin of cancer; for if the primary cancer, with all its metastases, histologically and histogenetically, is nothing more than a great family of epithelial cells, all of which have a common origin from preformed epithelium, then it is not possible for a parasite to be the chief etiological factor, as in the diseases which are known to be parasitic, such as a pus focus or an infectious granuloma. The pus focus is a purely local manifestation, be it either a primary or metastatic pus focus. Tubercular foci, gumma, leprosy, etc., are purely local developments wherever they occur, whether they are primary or secondary foci;; there is never any tissue connection between primary and secondary pus foci, between primary and metastatic tubercular growths.

In order to produce pus, or tuberculosis, etc., it is sufficient for the pus cocci, or tubercle bacilli, to reach suitable media; to bring about a secondary cancer, it is absolutely necessary that cancer cells from the primary or from a similarly created secondary tumor shall reach the particular spot, and there continue their growth. In the case of secondary cancers, we have to do with a successful transplantation of cancer cells; in the case of pus foci, or tuberculosis, there occurs a transplantation of the parasites, which do not themselves form the new focus, but they impel the local tissue, without any co-operation of the tissue of the primary focus, to certain pathological changes. Therefore there is an important difference between these two classes of phenomena; and one cannot conclude, that since in the case of pus foci, tuberculosis, etc., parasites play a rôle, this must also necessarily be the case in the carcinomatous new growths; one can, however, say, that if in cancer, parasites should happen to play a part, then these parasites must be of an entirely different kind than those above-mentioned, because they must bear the closest relationship to the cancer cells which characterize the growth. I do not consider it impossible for an intracellular parasite to play a part here; but it is impossible for it to play an independent part. It cannot possibly in itself be the decisive factor in the new growth; it cannot determine

the variety and the character of the new growth, since the cells themselves, and only they, do this.

I hold that the occurrence of such a parasite is not impossible; but how can we establish their presence?

Experiments to prove the power of transmission of tumors from one individual to another cannot in themselves demonstrate anything at all in this connection, for they only deal with transplantation of tissue to another individual. Just as periosteum transplanted to another animal has the power in its new host to grow and to form cartilage and bone; just as, to choose a still more analogous example, epidermis cells may be transplanted to a wound surface of another individual, and there attain a vigorous growth, so it is in the cases of successful tumor transplantation; in this case we have to do with only the production of a secondary tumor, a metastasis; upon a second individual, parasites need play no part whatever.

If it had been possible to produce tuberculosis only through the medium of tubercular tissue, then it could never have been proven that tuberculosis is caused by the tubercle bacilli. Only through the fact that the same result could be obtained by using pure cultures of the bacilli, entirely independent of the tissue elements as by using tubercular tissue; only through the fact that by means of pure cultures of the bacilli primary tuberculosis can be again reproduced in suitable animals; only by means of this could the parasitic nature of tuberculosis be absolutely established.

It is a matter of no consequence etiologically, in proving the transplantability of cancer, to produce a secondary cancer even upon another individual; but it is of consequence to produce a primary tumor. As long as that is not successfully accomplished, and that by means of an organism in pure culture, so long is also the parasitic nature of cancer not proved.

But now there remains one further question to decide, namely this, whether, according to the present state of our knowledge, we must not accept the parasitic origin of cancer. Long before the parasites of the infectious diseases were discovered, there could be no doubt that such must exist, and even

to-day such diseases are not wanting. (I mention only syphilis, in which we do not know the parasitic factors, but still do not doubt that they must be present.) Is the case of cancer analogous?

What is to be explained in cancer is the limitless and aberrant growth of epithelial cells. I cannot, and will not here go into an explanation of this problem. The case throughout is not such that a satisfactory explanation can be arrived at through the assumption of parasitic activity, rather that we are in a good position to comprehend all the phenomena in the morphology and biology of carcinoma without parasites.

The following are the conclusions which I have arrived at in respect to the parasitic etiology of carcinoma: (1) *No one up to the present time has produced proof that carcinoma is of parasitic origin;* (2) *There is no necessity to assume a parasitic etiology in carcinoma.*

THE PRESENT POSITION OF THE SURGERY OF THE HYPERTROPHIED PROSTATE.

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In 1893, the Annals of Surgery published a paper with the above title, in which I considered the subject under the following headings:

(1) The nature and chief varieties of the prostatic enlargement and their relation to the vesical changes found associated with them.

(2) The symptoms in relation to diagnosis and prognosis: (*a*) subjective; (*b*) objective.

(3) The indications for (*a*) non-interference; (*b*) medical treatment; (*c*) palliative treatment; (*d*) operative treatment.

(4) The choice of operation.

I shall briefly, and, for economy of space, without attempting to give detailed reasons, state the views under these respective headings which now seem to me to be entitled to at least provisional acceptance by the profession:

1. As to the essential causes of the enlargement, the existing theories may be summarized as follows:

It has been attributed to (*a*) the general arteriosclerosis of old age (Guyon); (*b*) a primary change in the bladder necessitating a compensatory hypertrophy of the prostate (Harrison); (*c*) a growth analogous to uterine fibromyoma (Thompson); (*d*) the persistence in an adjunct sexual organ, of physiological activity intended for the control and determination of the masculine characteristics, after the need for such activity had disappeared (White); (*e*) an attempt to compensate quantitatively for a qualitative deterioration in the prostatic secretion, whose function (Fürbringer) is to determine

the mobility and vitality of the spermatozoa (Rovsing); and, recently, (*f*) infection (most often by the gonococcus), aggravating a senile degenerative process (Geiger, Crandon); (*g*) inflammation extending from the urethra to the prostatic ducts and resulting in dilatation of the glandular alveoli (Herring, Daniel). None of these theories has been demonstrated, and some of them are insusceptible of demonstration, but that of Rovsing seems best to explain the shrinkage of the prostate which in many cases follows castration or vasectomy.

The gonococcus theory is sufficiently well supported to justify further investigation on the same lines, although at present the weight of evidence is distinctly against it. Some very interesting clinical facts may become explicable in the light of this theory if it should—as seems unlikely—receive confirmation. For example, Rovsing has recently reported five cases of double castration. In three, with no previous history of gonorrhœa, the results were extremely favorable. In a man of eighty-five, who had had total retention for eleven years, spontaneous evacuation of the bladder followed within six weeks; the other two, aged sixty-four and seventy-six, were alive and entirely well six years later. The two cases that showed no improvement had had gonorrhœa.

It is obvious that, as regards both prognosis and treatment, it is most desirable that we should discover the cause of prostatic hypertrophy. If the enlargement is merely one symptom of a general or constitutional condition, or if it is secondary to precedent changes in the bladder-walls, it would seem that much less could be expected from treatment than if it is dependent on causes at present unknown, but which may be said to be inherent in the structure or in the functional condition of the gland itself, or to be infective in character. If the changes in the bladder-walls and the accumulation of residual urine are the result of the precedent prostatic disease, treatment of the latter, if early and judicious, offers much more prospect of success. There is at present no reason to doubt that the vesical changes and symptoms are caused by (1) the

mechanical obstruction which the enlarged prostate offers to the ready and complete evacuation of the bladder; (2) the circulatory disturbance incident to pressure on the prostatic veins into which the blood from the vesical veins passes, and (3) septic infection.

2. In prostatic symptomatology nothing new that has any important bearing on diagnosis or prognosis has been added to our knowledge during the last decade.

(*a*) The *subjective symptoms* excited by prostatic hypertrophy may still be summarized as follows: Undue frequency of urination, especially at night; difficulty in starting the stream; feebleness of the stream; interrupted urination; urinary incontinence; retention of urine; changes in the urine; sensory disturbance; constitutional symptoms. They are all due to pressure of the enlarged prostate on surrounding parts, to obstruction of the prostatic urethra, and to inflammatory, atrophic, or degenerative changes resulting from this obstruction.

(*b*) The *objective symptoms* are still elicited by measuring the quantity of residual urine, by digital exploration through the rectum, and by such instrumental examination as will determine the length of the urethra, the seat, nature, and degree of the obstruction, the tonicity of the bladder, and the condition of the ureters, of the renal pelves, and of the kidneys themselves.

While progress has undoubtedly been made of late years in the simplification and improvement of many urethral and vesical instruments (especially of the cystoscope), no fundamental change has occurred, and it is still possible in the majority of cases to reach a sound conclusion as to the above points by a careful study of the history, and of the urine, and by the aid of catheters, vesical searchers, and the finger.

3. In considering the indications for treatment, the *classification* of cases of prostatic hypertrophy is of interest. It is well to determine (*a*) the predominant character of the growth, whether *soft*, indicating excess of glandular and muscular elements; or *hard*, showing advanced fibroid change. The dis-

tinction can be made more simply and accurately by rectal palpation than by any other method; (*b*) the seat of the growth, median, lateral, or general; (*c*) the presence or absence of general arteriosclerosis; and (*d*) the condition of the vesical mucosa and of the upper urinary tract as to pyogenic infection.

The last of these is the most important in its relation to the choice between expectant or palliative and operative treatment, and to prognosis.

4. As to the various possible plans of managing a case of prostatic hypertrophy, it may be said:

(*a*) That a purely expectant treatment is proper only in those cases (usually discovered during a rectal examination made for other purposes) in which the enlargement has produced no symptoms, catheterism is easy, and there is no residual urine.

(*b*) That no medical treatment is worthy of consideration except as, by means of urinary antiseptics, it may tend to prevent or mitigate the occurrence of infection.

(*c*) Palliative treatment still consists, as it did ten years ago, in either the systematic use of steel sounds or other instruments for purposes of dilatation, or in the employment of the catheter, and is still of value in a considerable number of cases. As to this important matter, after ten years' additional experience, and after carefully reviewing the literature, I believe the tendency of the profession should be—as it is—towards earlier operation, and that palliation—dilatation or catheterism—should be carefully restricted, and its effects watched with scrupulous exactness. There can be no doubt that the danger resulting from the pressure of residual urine in moderate quantity, while real, is less than that due to infection. If infection arose only from instrumentation, the use of the catheter might be properly delayed (when more radical measures are declined) until the residual urine was in quantity sufficient to begin to affect the general health by causing great frequency of urination, by backward pressure, or in other ways. As, however, infection occurs in many cases without previous instrumentation, as it is greatly favored by the congestion incident to retention, and as

the atrophic, ureteral, and renal changes from backward pressure are often unrecognizable in their early stages, and practically incurable later, the following rules as to dilatation and catheterism seem still to be applicable to some early and mild cases, and to many others in which, for any reason, operative treatment cannot be employed:

Dilatation.—A patient who presents the symptoms of the prostato-vesical congestion of the early stages of hypertrophy, who is disturbed once or twice at night, who has an enlargement of moderate density, appreciable through the rectum, but not offering much resistance to the introduction of an ordinary catheter, and who has but little residual urine, is likely to derive great benefit from the systematic introduction of full-sized steel sounds. I have always under observation a number of such patients in whom this treatment, and this alone, seems to relieve existing symptoms and to prevent, or at least delay, the development of further trouble. That it can have any true curative effect is unlikely; that it can even modify to any extent the continuous enlargement of the gland seems improbable, but that, either by producing a local atrophy in the parts immediately surrounding the urethra, or by simply stretching the canal itself and relieving local congestion and tumefaction, it mitigates the early symptoms, lessens the vesical irritability, diminishes the amount of residual urine, and modifies favorably the whole course of the case, seems to me beyond all doubt.

Catheterism should be systematically employed in cases in which the quantity of residual urine is three or four ounces or more, and in which the introduction of the instrument is easy and painless, and the urine is sterile. The frequency should be proportionate to the amount and character of the residual urine; a very good working rule (if the urine is sterile) being to use the catheter once daily (preferably at bedtime) for three ounces, twice for six ounces, and then once more for any additional two ounces. With sterile urine it is rarely necessary to use it oftener than once in every four hours.

The objections to habitual catheterism in prostatics are: (1) the risk of vesical infection; (2) the production of vesical

atony. These are very real and very serious, although not sufficient to contraindicate the employment of the method. The first may often, but not always, be avoided by scrupulous and unflagging care as to asepsis. The second is unavoidable, and this fact should be regarded as weighing in favor of operation in all cases where it comes up for consideration.

(*d*) Operative treatment should now be regarded as distinctly indicated whenever a progressive prostatic hypertrophy exists, or when, even in patients with but moderate obstruction, good compensatory hypertrophy of the bladder and a small amount of residual urine, catheterism is becoming more painful or more difficult, the urine shows fermentative changes, and the vesical congestion is passing into a true cystitis. -These indications become more definite and more urgent in almost direct proportion to the duration of the prostatic symptoms and to the age of the patient.

As distinct advance in operative methods has been made during this decade, and as we can offer to the average patient both greater hope of full relief and lessened risk, these indications, which are substantially those mentioned in 1893, should, in my opinion, be still further emphasized and insisted upon for the reasons that I then gave, viz., because, on the one hand, it is just at that period of the case when operation is for the first time clearly indicated and justified, and, on the other hand, that it promises most.

5. As to the choice of operation, it does not seem to me necessary to consider such methods as the injection of iodine, ergotin, or carbolic acid; the application of a continuous current through the negative pole inserted into the body of the gland through the rectum, the positive pole being applied to the abdomen; the application of the galvanocautery to the mucous membrane of the prostatic urethra by means of instantaneous flashes; the division of the bar at the neck of the bladder by means of a cutting instrument inserted through the penile urethra; the overstretching of the prostatic urethra; or the ligation of the internal iliacs. They were merely mentioned in 1893. They scarcely require mention now.

The section at the neck of the bladder by means of the electrocautery (Bottini) and its modifications, such as galvano-prostatomy (Chetwood), should in fairness be regarded as still on trial. The number and the professional position of their advocates render impossible the summary dismissal of these methods as unworthy of consideration. While I never mention them to my patients as among the alternatives presented to them, I recognize their theoretical advantages and await their satisfactory clinical demonstration. As I said in 1893: "It may be that some of them contain the germs of what is destined to be the approved and successful treatment of the future. At present, however, the evidence points in the contrary direction."

The remaining methods of treatment that are to be considered are (*a*) those directed to procuring shrinkage of the prostate by operations on the sexual apparatus (castration, vasectomy); and (*b*) the direct removal of the enlarged gland (prostatectomy).

(*a*) Doubtless many surgeons, probably most surgeons, would to-day dismiss castration and vasectomy from consideration as summarily as I have rejected interstitial injection or transrectal galvanism. It may be that they are entirely right. It was in the paper which I have taken as a basis of comparison in preparing this one—an address before the American Surgical Association—that I first suggested castration as a possibility in the treatment of prostatic hypertrophy. Ramm, of Norway, appears to have had the same idea at about the same time, but to have published nothing until later. Doubtless others had thought of it more or less vaguely, but no one seems to have tried to test its value experimentally as I had done previous to laying it before the profession.

As this is an "anniversary" number of the ANNALS, and is with propriety somewhat historical and retrospective in its character, I may be pardoned for quoting two or three sentences that indicate my own mental attitude at that time. I said towards the end of the paper: "I have one further thought which I have decided to mention to this Association, although I do so with a reluctance born of the fear of being considered

illogical or impractical, or perhaps both." I then went on to recall the well-known theory as to the analogy between uterine fibromyomata and prostatic overgrowth, the effect of oophorectomy on the former, the testimony as to the infantile character of the prostate in eunuchs, the observations of John Hunter and Griffiths upon the prostates of the mole, the hedgehog, and the bull, and finally described the results of the experimental castration of dogs (Kirby)—with control experiments—in the following words: "These results, which I believe may be relied upon, place beyond all peradventure the influence of castration (in the dog at least) upon the condition of the prostate, and show clearly that the operation is followed invariably, and with a promptness which I must confess was to me surprising, by atrophy first of the glandular and then of the muscular elements, and by a coincident reduction in both bulk and weight." After discussing the possibility of making these facts a basis for the employment of castration in prostatic hypertrophy, I said: "I do not desire to be understood as insisting upon the truth or even upon the probability of the above hypothesis. I have simply, with much hesitation, determined to follow out publicly a line of thought that had occupied my mind at odd times, and to submit it to your criticism;" and added: "I might admit, finally, that I have not had the courage of my convictions, and have never seriously sought to recommend the operation, but it would be truer to say that I have as yet no definite convictions, and that I am simply seeking enough light upon the subject to convince me either that it is worth pursuing further, or, on the other hand, that it offers no possibility of practical usefulness."

Even with so cautious a presentation of the subject, however, the operation was taken up all over the world with great rapidity, and large numbers of patients were subjected to it, some of them, as the reports show, already moribund. Many cases were operated upon and the immediate results published before I had myself found what I regarded as a case suitable for this procedure.

I had spoken of the operation as one "with a low mor-

tality," and so conservative a surgeon as Lord Lister, in commenting on my paper, remarked that I should have said "with no mortality." I was disappointed to find that a very considerable mortality was reported. It was true that the majority of the deaths were obviously in spite of, not because of, the operation. Still, the death-rate was larger than any one had anticipated. Two years later (July, 1895) I was able to gather from surgical literature and through correspondence, and to report in the ANNALS, a series of 111 cases that had been operated upon. The deaths were twenty, thirteen of which I thought should be excluded in an attempt to arrive at the legitimate mortality, as they had occurred in cases that were obviously at the point of death when operated upon. Still, even with this exclusion—which was not assented to by the critics of the operation—the remaining mortality of 7 per cent. was greater than I had anticipated.

A glance at that paper with its table of cases will show apparently (according to the reports of surgeons from all countries in the world) that in about 85 per cent. of cases such diminution in size of the prostate had rapidly followed the operation that it was thought to be analogous to, or identical with, the atrophy I had experimentally shown to occur in dogs; that long-standing cystitis had disappeared or greatly lessened in more than half the cases; that distinct amelioration of the most troublesome symptoms had occurred in over 80 per cent. and a return to local conditions not very far removed from normal in 46 per cent. of those operated upon.

At this time I felt hopeful as to the future of the operation, and defended it to the best of my ability, on the basis of these clinical reports of actual cases. I was doubtless too easily convinced, as, judged by their reports, were many other surgeons, and perhaps my defence was often—as is not uncommon in controversial literature—somewhat too vigorous; but by the end of 1896 I said (ANNALS OF SURGERY, Vol. xxiv, page 398) that I would be quite content if nothing better could ever be said of the operation than Dr. Arthur Cabot (who had been a keen and thoughtful critic from the beginning) said would

be justified by the then existing statistics if further experience confirmed them, viz., "We shall be able to express the facts thus to our inquiring patients: You have eight chances in ten of getting through the operation all right, and if you are successful in this, you have again eight chances in ten, or a little better, of getting very substantial relief from your urinary difficulties."

In 1900, Dr. Alfred Wood published (ANNALS OF SURGERY, Vol. xxxii, page 309) a collection of 159 cases of castration, and 193 cases of vasectomy, none of which had been included in my table of 1895, or in Cabot's table of 1896. The reported results of the castrations showed thirteen deaths (a little over 8 per cent. of mortality), and with some variations corresponded approximately to the results shown in the earliest table. In the vasectomies the mortality was 6.7 per cent., and in 67 per cent. some form of general improvement was noted.

In the same year (1900) Mr. Reginald Harrison reported more than 100 cases of vasectomy, and said that he had been able to observe "benefit of some kind and in some degree in almost every case, although the accompanying conditions often prevented anything like a cure."

In 1902, Rovsing reported forty cases of vasectomy, of which twenty-seven were cured, nine relieved, and four unimproved. There were no deaths. He adds: "I should under no circumstances feel myself justified in undertaking the total extirpation of the prostate in a patient in whom I had not done a vasectomy, which in many cases gives such extraordinary relief."

Since then no notable papers on this subject have been published. I may be pardoned for adding that during the decade during which this evidence has been accumulating I have in my own practice—including both private and hospital patients—found but fifteen cases in which I thought castration justifiable, and thirty-seven cases in which I have performed vasectomy. I mention these figures merely to indicate that I have tried to preserve the conservatism with which I suggested the operation originally.

My present opinion is that castration and vasectomy are

likely to occupy a more and more restricted field in the treatment of prostatic hypertrophy. In properly selected cases I still think that they are likely to have a low mortality, and that when fully successful they secure a return to a condition more closely resembling the normal than most of the other operations looking towards a radical cure of the hypertrophied prostate. They certainly cannot, however, be said to be gaining ground in the favor of the profession. Although in the several hundreds of reported cases the outcome seemed in the majority of instances to be satisfactory to the operators, these procedures have been gradually given up in favor of various others more recently advocated. The uncertainty of their results, both immediate and remote; the fact that they are not free from danger; and, so far as castration is concerned, the strong and not unreasonable sentimental objections to it, combine to render their final status in the treatment of prostatic hypertrophy a matter of doubt. It may be that a better classification of prostatics in accordance with their clinical history will resolve this doubt.

In the meanwhile, without the least disposition to urge these operations upon the profession, or to claim anything for them which facts do not justify, I would suggest that they still merit at least occasional consideration; that not *all* of the published reports of successes can be inaccurate or misleading; that such testimony as Harrison's or Rovsing's should not lightly be ignored; and that it is quite possible that there may still be a definite field of usefulness for these procedures, although I now believe that it will be much more limited than I at one time thought it would be.

(*b*) My opinion as to the greatly—and justly—increased limitations of these operations in the future is much influenced by the improvement, to which I have already alluded, in the method of performing prostatectomy.

Largely through the work of one surgeon, Mr. P. J. Freyer, suprapubic enucleation of the entire gland has during the last decade become the operation of choice in the majority of cases. He opens the bladder in the usual way, having intro-

duced and left *in situ* a hard-gum catheter. He scratches or scrapes through the mucous membrane over the prominent portions of the prostate, which, he says, will usually be found by pressure to have so thinned the fibrous sheath formed from the pelvic fascia that the finger comes down on the true capsule of the prostate. This is deficient along the upper and lower commissures or bridges of tissue that unite the lateral lobes above and below the urethra. These lobes are separate in early fœtal life, and tend to revert to this condition and become more distinct when hypertrophied. Accordingly, it is possible, by following the capsule closely with the finger, to enucleate the whole prostate, usually leaving the urethra intact, and sometimes even the ejaculatory ducts. The prostatic plexuses, which lie between the fibrous sheath and the true capsule, are left behind, and the hæmorrhage is therefore trifling. During the procedure the prostate is steadied from beneath, through the rectum, by the fingers of the operator.

The greater simplicity, lessened risk, and more satisfactory results claimed by Mr. Freyer for this operation, as compared with previous methods of prostatectomy, have been demonstrated by his own published experience, and by those of the many surgeons who are now beginning to record their testimony. Up to July of this year, Mr. Freyer had done "total enucleation" in 110 cases, the patients varying in age from fifty-three to eighty-four years, the average age being a little over sixty-eight years, and the prostates weighing from three-quarters of an ounce to fourteen and a quarter ounces, with an average weight of three and a quarter ounces. The majority of the patients had been entirely dependent on the catheter for varying periods extending up to twenty-four years. Nearly all of them were in broken health, and many were apparently moribund when the operation was undertaken. The great majority of them were said to be "reduced to such a wretched condition that existence was simply unendurable." Few of them were free from one or more grave complications, such as cystitis, stone in the bladder, pyelitis, kidney disease, diabetes, heart disease, thoracic aneurism, chronic bronchitis, paralysis, hernia,

hæmorrhoids, etc. This is, of course, a summary of the unpromising conditions recognized by every surgeon as those under which the operation must usually be undertaken.

In three of the cases the disease was malignant. One of these died, the other two recovered. Excluding these three, there were left 107 cases of complete removal of the prostate for adenomatous enlargement, ninety-seven of which were "successful." Mr. Freyer defines "success," as he uses the term, as meaning that the patient regains the power of retaining and passing the urine naturally, without the aid of a catheter, as well as he ever did. He adds: "In no instance has the patient failed to regain the power of voluntary micturition without the aid of a catheter. There has been no instance of relapse of the symptoms; on the contrary, lapse of time only seems to consolidate the cure. In no case has there been contraction at the seat of operation leading to stricture; nor has there been any instance of a permanent fistula remaining."

Of the ten deaths, he thinks that four, or at most five, can be attributed to the operation itself, and that the remainder were due to diseases incident to old age. This seems to me, as I have always contended, a fair way of estimating the risk of a new procedure, or a procedure that is new as applied to a given condition. It would give in his series of cases a mortality of less than 6 per cent. But, accepting all the deaths as having relation to the operation, the mortality is only about 9 per cent., which, considering the precedent condition of the patients, is extraordinarily small. Mr. Freyer says that if the operation were undertaken in selected cases only—cases in which the general health was unimpaired—the mortality might be still further reduced; but I agree with him that any such restriction would be unjustifiable, as it would have the effect of excluding the great majority of the patients who at present seek relief from this operation. I agree, too, with Mr. Freyer that, as the operation becomes more widely known and more popular, patients will no doubt seek relief at an earlier period of the disease, whilst their constitutions are sound and with a much greater prospect of success; and that increased experience in

operating, improvement in the details of the after-treatment, and better nursing, are all factors that will tend to reduce the death-rate.

My own personal experience with the operation tends to confirm all of Mr. Freyer's claims.

The anatomical discussion as to the possibility of "total enucleation," as to the presence of a "true" capsule, as to the retention of the uninjured prostatic urethra, etc., has been and is interesting, but the clinical results of the operation make such discussion seem of academic rather than practical importance.

As to the other methods of prostatectomy,—the perineal, the "combined," etc.,—there can be no doubt that they have often given good results in the hands of some surgeons, and are still the methods preferred by a number of able workers in this field. There are probably cases for which they will always be found specially suitable, but at present it appears to me that such cases will be exceptional, and that past experience does not justify the expectation that the results of prostatectomy by the perineal route will compare favorably with those of the "total enucleation" above described.

INTUSSUSCEPTION OF MECKEL'S DIVERTICULUM.

REPORT OF A CASE COMPLICATED BY STENOSIS OF THE INTESTINE BELOW LEADING TO SECONDARY INTUSSUSCEPTION OF THE SMALL INTESTINE.

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THE following case is worth recording on account of its extreme rarity:

The patient, G. W., aged nineteen years, billiard-marker, was admitted into King's College Hospital on March 12, 1904. The patient gave a history of indefinite abdominal discomfort lasting for about two years, which culminated in an attack of vomiting and diarrhœa in July, 1903. This attack was followed by others at intervals of about a couple of weeks. The usual history of these attacks was that the abdominal discomfort, flatulence, etc., increased until vomiting occurred. The amount vomited was copious, of a greenish or yellowish character, and its ejection was followed by marked relief. The attacks had of late increased in frequency until they occurred about once a week. His previous history was unimportant, except that when a child he was said to have suffered from "consumptive bowels."

On admission the patient was fairly well nourished, pale, with dry lips, but without any distinct anxious expression. The abdomen moved normally on respiration, was only very slightly distended, and, with the exception of a spot about an inch and a half below the umbilicus in the middle line, there was no tenderness. In the left iliac region there was a tympanitic note on percussion, and a good deal of gurgling could be felt in this region. Nothing could be made out per rectum. The temperature was normal.

On March 16 the patient had his first attack of vomiting in the hospital, about two pints of semiliquid material being brought up. The vomit contained about 65 per cent. of hydrochloric acid, but was not otherwise abnormal. Since admission there had been

no rise of temperature, and the bowels had acted twice daily without any aperient.

On March 19 he complained of a good deal of flatulence and abdominal pain. About mid-day the pain became more acute, being referred to the epigastrium, and a distended loop of bowel appeared in the left iliac region. This was tender, but quickly disappeared on being touched. In the afternoon the patient vomited about twenty-eight ounces of fluid and the symptoms were relieved. Later, however, the relief afforded by the vomiting passed off, and the patient was again in great pain. Another loop of bowel could be seen just below and to the right of the umbilicus; this again rapidly disappeared on being handled, and its disappearance was accompanied by a distinct gurgle. The resonance of the left iliac region was impaired and an indefinite lump could be felt there. Later in the evening the patient had another attack of pain more acute than the first; there was again vomiting,—sixteen ounces,—and the bowels were moved, the motion containing mucus but no blood. Indeed, no blood had been passed per rectum at any time.

The next day, March 20, the patient was more comfortable in the morning, but in the evening the pain returned. There was again a distended coil of intestine to be seen, and vomiting also occurred; but on this occasion the pain was not relieved by it. There was still impaired resonance in the left iliac fossa. The pain was distinctly colicky and was very severe. It was relieved by a subcutaneous injection of morphine. The pain continued to come on in spasms during the 21st, and a rounded, soft swelling could be felt just below the umbilicus, which became distinctly harder when the spasm of pain came on. The vomiting persisted.

The following day, March 22, the patient became much more exhausted, but the vomiting had ceased. The pain was just the same as before and of a colicky character, but there was no abdominal rigidity.

March 23. The abdomen was opened in the middle line, the umbilicus being about the centre of the incision. A coil of distended and much congested small intestine presented itself. On further examination a large intussusception was found lying in the pelvis. The mass was brought out of the abdomen, sterilized cloths were packed around, and the intussusception, which was about eighteen inches long, was easily reduced, there being no

lymph nor any tendency to adhesion at all. When it was reduced, a second intussusception presented itself, and this again was easily squeezed out, and there were no adhesions between the intussusceptum and the intussuscipiens. A mass was now felt, in which there was again an intussusception to be noticed, which could not be reduced, and the whole mass was so inextricably involved that it seemed best simply to excise it. The intestine was therefore cut across above and below, both ends were stitched up, and a lateral anastomosis was made. The upper portion of the bowel was so enormously dilated as compared with the lower that an end-to-end union did not seem likely to be satisfactory. The piece of bowel involved was the small intestine. Its exact position above the ileocæcal valve was not ascertained, but I should think it was from two to three feet above.

The patient was severely collapsed after the operation, and there was a considerable amount of colicky pain and rather troublesome nausea. However, the patient very soon improved, and on March 26 the note is that "The patient's condition is much improved; he has begun to take small feeds by the mouth in addition to rectal feeding, and has lost his pain." From this time onward the patient progressed without any bad symptom. The wound healed by first intention, and by the time he left the hospital, on May 11, he had completely recovered, felt well, and was rapidly gaining in weight, having made nine pounds in the last fortnight.

Description of the Portion resected.—The lower part (*E*) (Fig. 1) consisted of small intestine, which had apparently formed the apex of the second intussusception. It had evidently been constricted; its mucous membrane was smooth and covered with villi; but there were no traces of any valvulæ conniventes, and there were only slight rugæ towards the upper end. About an inch of this portion of the intestine had been cut off.

At the upper end, the lumen of the bowel rapidly narrowed till there was only a narrow channel (*C*) connecting this portion (*E*) of the intestine and the distended upper portion (*A*). This channel was lying at the border of the mesentery. It was about two and one-half inches long; it was about the caliber of a goose-quill; the wall of it was thickened and composed of scar tissue, and it was for the most part apparently devoid of mucous membrane. This narrow canal joined the intestine above (*A*), which

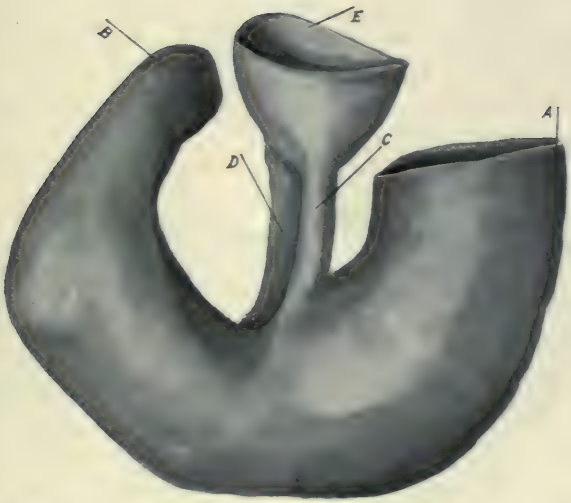


FIG. 1.—*A*, Upper part of bowel; *B*, diverticulum pulled out; *C*, narrow tube connecting the upper and lower parts of the bowel; *D*, mesentery; *E*, lower part of bowel.

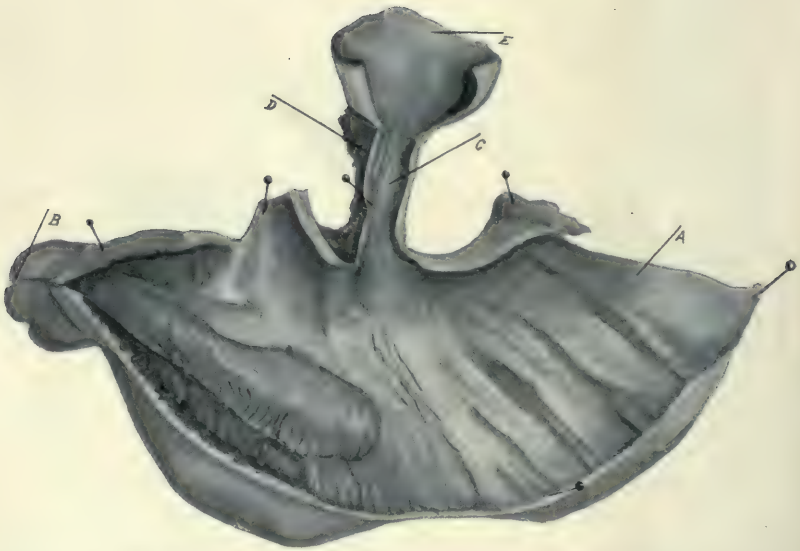


FIG. 2.—*A*, Upper part of bowel; *B*, diverticulum inverted; *C*, narrow canal connecting the upper and lower parts of the bowel; *D*, mesentery; *E*, lower part of bowel.

was enormously dilated. From the point of junction, the intestine on the one side ran upward and was continuous with the intestine above, which was enormously dilated; on the other side of the attachment of this canal there was an abnormal diverticulum which was invaginated. The diverticulum when pulled out was four inches long. It was conical in shape with smooth peritoneal walls. Its inner surface showed a ridge which corresponded to the mesenteric attachment. (Fig. 2.) This diverticulum (*B*) was filled up by a pyriform structure consisting of the intussuscepted swollen terminal portion, the end of which hung into the distended upper portion of the intestine. This projection consisted mainly of mucous membrane and submucous tissue, but at the outer part the serous membrane was also invaginated for about an inch: a probe could be passed into the pedicle of the diverticulum from the peritoneal cavity. The mucous membrane covering it was normal and covered with villi and valvulæ conniventes. The whole of the structures described, namely, the distal portion of the bowel just below the constricted part, the constricted portion itself, and the diverticulum, had been invaginated into the portion of bowel below, the apex of the intussusceptum being formed by the bowel just below the stricture.

The case is clearly one of an intussuscepted Meckel's diverticulum, and, like several of the cases of this condition which have been published, it is essentially the mucous membrane which is invaginated. The case, however, differs from those published, with one exception (Ewald's No. 13), in that there is a narrow strictured canal connecting the upper and lower portion of the intestine. As to the origin of this canal, I should think that it is most probably a congenital stricture of the small intestine. Congenital strictures of the small intestine have been described as occurring along with and at the point of attachment of a Meckel's diverticulum, and probably this strictured portion had become narrower of late on account of sloughing of the mucous membrane. Against this view may be urged the fact that the patient for seventeen years had given no indication of having anything wrong with his intestine, but it is quite possible that the stricture had become tighter of late; in

fact, this is highly probable, seeing that some inflammatory process had been going on leading to disappearance of the mucous membrane and thickening of the walls, and thus the stricture may have become so much narrower as to interfere with the proper passage of the intestinal contents. It is probable, also, that the occurrence of the intussusception of the Meckel's diverticulum had increased the trouble, the end of the intussuscepted portion lying like a valve over the orifice of this narrow canal. I should think that the train of events probably was that the patient had a Meckel's diverticulum, and had a fairly narrow congenital stricture of the intestine; that the discomfort to which the latter gave rise was comparatively slight, and the patient had become so accustomed to it that he did not notice anything abnormal; that inflammation of the mucous membrane of this strictured portion occurred, leading to swelling and increased obstruction; and that, as the result of the efforts of the intestine to overcome the obstruction, the Meckel diverticulum itself had become invaginated; that, once this had taken place, the end of the invaginated portion lay like a valve over the opening of the congenital stricture, and thus increased the obstructive troubles; and then, as the result of the violent and constant peristaltic action, the affected portion of the intestine, namely, the diverticulum and the stricture, had become invaginated into the intestine below. The invagination had not been so tight as to interfere with circulation; hence there were no adhesions between intussusceptum and intussuscipiens. The curious condition of the original intussusception having become again invaginated into the bowel below was probably of recent occurrence.

On searching the literature, I find reference to sixteen cases of intussusception of a Meckel's diverticulum; but in only one of them (Ewald's) do I find mention of a stricture as well. Seven of these cases were collected some years ago by Küttner (see *Beiträge zur klinischen Chirurgie*, Vol. xxi, 1898), and Halstead, in the ANNALS OF SURGERY, Vol. xxxv, 1902, in a paper on troubles connected with Meckel's diverticulum, gives a list of cases in which I find several in which in-

vagination of the diverticulum had occurred. In his paper he states that twelve cases in all had been reported. Other isolated cases have also been published, making with this case of mine seventeen in all.

Two views have been expressed as to the mode in which invagination of the diverticulum takes place. Küttner looks on its occurrence as due to active peristaltic action on the part of the diverticulum itself: in one of his cases this was set up by a polypus, in another by the presence of an accessory pancreas. In other cases where the etiology is not clear, Küttner thinks that the diverticulum becomes filled with fæcal matter, and in the peristaltic efforts to dislodge it invagination takes place, and once this has occurred the peristalsis is increased and the invagination rapidly progresses. De Quervain thinks that the invagination occurs in a passive manner, namely, that the rapid flow of the intestinal contents past the orifice of the diverticulum produces a negative pressure in the diverticulum, and thus draws it into the intestine. I must say that I can hardly think that the latter view is a likely one.

In most of the cases it is noted that it is chiefly the mucous lining of the diverticulum which has become invaginated, probably due to the loose attachment of the mucous membrane. Of course, once the diverticulum has become more or less inverted into the bowel, the subsequent occurrence of intussusception of the intestine is quite a natural result. It may, however, be noted that in a number of cases only the diverticulum has been found invaginated without any intussusception of the intestine. Hohlbeck found that in twelve published cases there was intussusception of the diverticulum alone in five, and in seven, intussusception of the intestine as well (four times iliac, once ileocolic, and twice ileocæcal).

The following is a list of all the cases published, including those collected by Küttner and Halstead:

1. Hohlbeck. (*Archiv für klinische Chirurgie*, Vol. lxi, 1900.)—Female, aged nineteen years. Severe pain in the abdomen and obstructive symptoms three days before admission. Sausage-shaped tumor felt in the ileocæcal region. Abdomen opened on the outer side of the right

rectus. Ileocæcal invagination found; reduced, and then an abnormal Meckel's diverticulum found, which was removed. Patient died two days later. On examination the mucous membrane lining the diverticulum was separated from the muscular coat and invaginated, forming a floating tumor in the lumen of the intestine.

2. WAINWRIGHT. (ANNALS OF SURGERY, Vol. xxxv, 1902.)—Male, aged seventeen years. Six days before admission, failure of appetite, sense of fulness, constipation. Worked for five days. Then severe pain in epigastrium and complete obstruction and vomiting. No tumor. High oil enema given, but returned with blood only. Abdominal section. Eight ounces of clear serum in the peritoneum. Sigmoid and cæcum empty. Intussusception three inches long, about three feet from the ileocæcal valve. Invagination easily reduced; no adhesions. It was then found that there was a diverticulum which was itself inverted, the inverted apex of it evidently forming the apex of the intussusception. Easily reduced; the diverticulum clamped and cut away. Recovery uneventful.

3. DE QUERVAIN. (*Centralblatt für Chirurgie,* 1898.)—Male, aged sixteen years. Seized suddenly with violent abdominal pain and vomiting. Repeated action of the bowels. No diagnosis made. Laparotomy. Foul-smelling bloody fluid found and an intussuscepted piece of small intestine. Gangrene had occurred at the neck of the intussusceptum. Resection of the intussuscepted portion, which was ten centimetres long, and an artificial anus formed. Death in a few hours. On opening the invagination, a polypoid structure about five centimetres long was found somewhat swollen at its end. This was an inverted diverticulum.

4. STUDSGAARD. (*Centralblatt für Chirurgie,* 1894, quoted from De Quervain.)—Male, aged thirty-seven years; admitted with peritonitis and intussusception of the ileum; laparotomy; resection; death. The intussusception was found to be caused by an invaginated diverticulum.

5. BRUNNER. (*Beiträge zur klinischen Chirurgie,* Vol. xxv, 1899.)—Patient aged four years. Seized suddenly with abdominal pain three days before admission. Passed blood afterwards. No proper action of the bowels. Diagnosis of intussusception. Laparotomy. Ileocæcal intussusception found. Irreducible. The portion resected. Patient did well. Resected portion measured twenty-two centimetres. On looking into the cæcum, a bell-like, firm tumor was seen to be hanging into it; it was somewhat pear-shaped and bent towards the mesenteric side; it had a pedicle attached to the small intestine. The surface of the tumor covered with mucous membrane. On further examination an accessory pancreas was found on the serous side of this projection covered with a fold of fat. This had apparently led to the invagination. The case was therefore an accessory pancreas at the blind end of a true diverticulum of the intestine. As the result, invagination of the diverticulum, and subsequently invagination of the ileum through the ileocæcal valve.

6. VON STUBENRAUCH. (*Centralblatt für Chirurgie,* July 2, 1898.)—Girl, aged five and a half years. Acute seizure, bloody stools, colic, diarrhœa, etc., five days before admission. Sausage-shaped tumor. Laparotomy performed. Intussusception ten centimetres above the ileocæcal

valve. Intussusceptum gangrenous. Death two hours later. In addition to the intussusception of the small intestine, there was an inverted Meckel's diverticulum.

The following four cases are taken from Halstead's paper (ANNALS OF SURGERY, Vol. xxxv, 1902):

7. ROBINSON. (*British Medical Journal*, 1899, Vol. ii.)—Male, aged five years. Acute pain referred to umbilicus; abdominal distention; tumor on the right side of abdomen. Diagnosis, intussusception. Resection; death two hours later. Invagination of diverticulum and intussusception of the small intestine as well.

8. ADAMS. (*St. Bartholomew's Hospital Reports*, 1891.)—Male, aged forty-two years. Symptoms obscure, rather chronic. Evidence of obstruction lasting two weeks. No operation. Death. Invagination of diverticulum and ileocolic intussusception.

9. ADAMS. (*St. Bartholomew's Hospital Reports*, 1891.)—Male. No clinical history. At autopsy, intussusception of diverticulum.

10. WEILL ET FRAENKEL. (*Bull. de la Soc. de Anat. de Paris*, 1896.)—Female, aged four years. Acute ileus, one day's duration. Invagination of diverticulum and ileum. Resection of intestine; suture. Death.

The remaining cases are from Küttner's paper in the *Beiträge zur klinischen Chirurgie*, Vol. xxi, 1898:

11. KÜTTNER. (*Beiträge zur klinischen Chirurgie*, Vol. xxi, 1898.)—Female, aged forty-nine years. Symptoms of acute obstruction for three days. (Similar attack eight weeks previously, which passed off suddenly after five days.) Great distention. Laparotomy. Pus in the pelvis. State of matters not made out. Pus sponged out. Anastomosis between dilated intestine above and collapsed intestine below. Death. On examination, polypus-like structure found in the intestine about seven centimetres long, which proved to be a Meckel's diverticulum invaginated and projecting into the small intestine. It was situated about ninety centimetres below the commencement of the jejunum. In the middle there was gangrene of all the layers of the small intestine and three minute perforations.

12. MARONI.—Man, aged twenty-six years. Intestinal obstruction. Abdomen opened. Found torsion of small intestine, which was rectified; but patient died. Post-mortem: a second complete obstruction in the lower part of the ileum due to a Meckel's diverticulum inverted into the lumen of the bowel. The invagination was caused by a polypus in the diverticulum.

13. EWALD.—Female, aged forty-two years. Has had several attacks of violent pain in the abdomen, constipation, and vomiting, from which she recovered. She died in the last of these attacks. It was found that there was a Meckel's diverticulum which had become invaginated into the

intestinal canal. In addition there was a stenosis of the intestine scarcely admitting a lead-pencil. In the centre of the inflamed part was a small perforation which had led to suppurative peritonitis.

14. HELLER, in a pathological specimen, found a true intussusception of a Meckel's diverticulum.

15. HELLER.—Post-mortem result in a patient aged fifty-six years who had died of perforating ulcer of the stomach. Movable cord found in the lumen of the intestine with a marked swelling at the end. A hollow on the outside about one centimetre from the mesenteric attachment, cause of invagination of the diverticulum. At the apex of the diverticulum was an accessory pancreas.

16. HELLER.—Post-mortem in a patient who died of pyonephritis; 180 centimetres above the ileocæcal valve a worm-like body, about ten centimetres long, projecting into the small intestine, covered with mucous membrane. This was an invagination of a diverticulum of the small intestine.

THE OPERATIVE TREATMENT OF CANCER OF THE BREAST.

WITH AN ANALYSIS OF A SERIES OF ONE HUNDRED CONSECUTIVE CASES.

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THE new method of operating upon the breast for cancer has now been in use for a sufficient length of time to enable even the most critical observers to obtain a satisfactory estimate of its value.

The reports which have been received from time to time by various writers fail usually to give as complete and convincing details as to the relief or curability of cancer by this operation as the professional public would like to obtain.

With this end in view therefore, the writer has collected a series of 100 consecutive cases of cancer of the breast, taken from his hospital and private practice, in which at least three years have elapsed from the time of operation.

These cases have all stood the test of careful microscopic examination,—in the large majority of the cases by one observer (Dr. W. F. Whitney),—and their subsequent history has been relentlessly followed up by Dr. Walter B. Odiorne. The returns are therefore so far complete that the writer is able to give end results bearing upon all important points of interest in connection with this operation.

This group represents an average set of cases such as the surgeon would consent to operate upon with hope of benefit, if not of cure, to the patient. There has been no attempt to select favorable cases, only those cases being rejected where it was manifestly impossible mechanically to remove the disease with the knife. The results may therefore be said to give us

an idea of what we may expect to accomplish under the usual conditions of surgical practice. A careful analysis of the different types and stages of the disease shows also what we have a right to hope for under more favorable conditions.

During the period embraced by this series, which covers nearly two decades, the operation has undergone many radical changes; but even in the earliest cases the scope of the operation was a sufficient departure from old methods to bring them within the pale of modern work. The ever-increasing improvement in technique and diagnosis and the education of medical men to recognize the importance of early surgical interference will justify the hope that still more encouraging results may eventually be obtained than are shown in this article. It is now my custom, in all cases of tumor of the breast, in which there is uncertainty as to the nature of the growth, to explore the gland through the so-called Thomas incision, and thus arrive at the earliest possible diagnosis.

Etiology.—There are some interesting facts brought out under this head, particularly those bearing upon the origin of the disease in pre-existing lesions of the breast. There were five cases in which it was evident that cancer had developed as a secondary process in either a cyst wall or in that chronic inflammatory condition of the gland tissue which is the accompaniment of cystic degeneration. In three other cases, not in this series, I have also observed the changes of cyst into cancer. One of these cases I saw nearly two years before operation was finally performed, and cancer was then found growing in the cyst wall.

All but one of the five cases in this series are reported as "cures." In another case cancer was found growing in a small fibroma, about the size of a horse-chestnut, which had existed for over twenty years. Such experience is strong testimony in favor of the early operation of non-malignant tumors of the breast. Still more marked is the influence of true inflammation, whether arising from sepsis or trauma. There was a history of abscess in six cases and a history of some kind of blow in sixteen cases. Adding these cases together, we

find the existence of a pre-existing lesion of some kind in twenty-eight cases. There was a family history of cancer in eighteen cases. The age of the patients is definitely known in ninety-nine cases, and the following table shows the disease to be most commonly observed in the sixth decade.

Age of Patients at Time of the Appearance of the Disease.—One case observed between the age of 20 to 29 years (inclusive); 14 cases between 30 to 39 years; 28 cases between 40 to 49 years; 36 cases between 50 to 59 years; 15 cases between 60 to 69 years; 5 cases between 70 to 79 years.

The average age of those cases cured by operation was 52.9 years. The youngest cured was thirty-one years old and the oldest seventy-three years old.

Diagnosis.—The pathological diagnosis was made in the great majority of cases by one individual, and the terms used, therefore, have a distinctly comparative value. "Medullary cancer" was the report in forty cases; "cancer" in twenty-six; scirrhus in twenty-eight; adenocarcinoma in three; colloid cancer in two, and Paget's disease in one. A careful record in duplicate was kept of the diagnosis of the case in every operation performed at the Massachusetts General Hospital, and a similar system was carried out at each operation in private practice. A pathologist is present at each operation, and a provisional diagnosis is made by the microscope at the time. A report is made also of the condition of the lymph-glands removed, and dissection is continued until the report comes back that the last gland removed was not infected. If the disease approaches too near the healthy border of the structures removed, the operator is immediately advised of the condition. This system has been carried out in nearly every case, and the writer has found it of the greatest assistance in making an intelligent dissection of the parts involved. Of late, microscopic sections of the specimens have been preserved, and it has thus been possible to make a new study of certain cases, those in which a cure has been effected being of special interest.

One most valuable feature of this system, that is, of having a trained pathologist at the operating-table, is the pos-

sibility of thus saving all breasts in which the growth is not malignant. In this way, and by means of the Thomas incision, the mammary gland may be inspected from behind, benign morbid growths removed, and the organ restored to its original contour. The writer has devised an operation for this purpose, which he proposes to describe at length in another article as " Plastic resection of the mammary gland."

Prognosis.—Of these 100 cases there are twenty-six that can be regarded as cured, that is, the patients are either alive now (free from recurrence) or have died from other causes than cancer at a time three years or more after the operation or after the removal of recurrent growths. These cases are Nos. 1, 2, 3, 4, 5, 9, 14, 19, 20, 35, 38, 39, 42, 44, 54, 59, 60, 64, 66, 76, 77, 79, 81, 93, 97, 98.

Two of these cases had recurrences,—one in the axilla and one in the pectoral region. The former appeared five years and the latter nine years after operation. These nodules were removed, one fifteen years ago and one ten years, and both patients are alive and well at the present time.

Seven of the twenty-six cases have died of causes other than cancer, there having been no recurrence in any case at periods from four to fourteen years after the operation. These cases have been subjected to searching inquiry, and the writer is satisfied that death was in no case due to cancer.

Cause of Death in " Cured" Cases.

CASE 2.—Apoplexy, 10 years after operation.

CASE 5.—Cholera, 6 years after operation.

CASE 9.—Pulmonary hæmorrhage, 14 years after operation.

CASE 20.—Grippe, 13 years after operation.

CASE 42.—Pneumonia, 10 years after operation.

CASE 60.—Apoplexy, 8 years after operation.

CASE 77.—Pneumonia (myxœdema), 4 years after operation.

In addition to these cases there are four patients, who are alive and well without further recurrence, in whom recurrent

nodules have been removed. These cases will be referred to more at length under the head of "recurrence."

We have therefore at the present time twenty-three cases that are alive and well and seven that have died of other causes than cancer,—a total of thirty out of 100 cases, or nearly one-third.

Of the remaining nineteen cases in which the patient is alive and well without recurrence over three years after operation,

1	is	alive	and	well	20	years	after	operation.
1	"	"	"	"	19	"	"	"
1	"	"	"	"	18	"	"	"
1	"	"	"	"	14	"	"	"
1	"	"	"	"	11	"	"	"
2	are	"	"	"	10	"	"	"
2	"	"	"	"	8	"	"	"
3	"	"	"	"	7	"	"	"
5	"	"	"	"	5	"	"	"
1	is	"	"	"	4	"	"	"
1	"	"	"	"	3	"	"	"

It will be observed that the majority of living "cures," twelve out of nineteen, range on this list from five to ten years after operation,—there being only five living over ten years after operation.

This small number is to be accounted for by the average age of the patients, fifty-three years, as those who have survived the operation ten years are always liable to the susceptibilities of elderly people, as the table of deaths from "other causes" shows. Recurrence, as will be seen lower down, has played no part in the mortality of the more mature cases, for in no case has a recurrence been seen after a period varying eight to nine years after the operation.

The pathological status of the cases cured is interesting, and a study of this point is suggestive as valuable aid to the prognosis in any given case. In two cases the diagnosis was "colloid cancer;" in six cases "cancer;" in twelve cases "scirrhus;" in three cases "medullary cancer;" in one case Paget's disease, and in two cases adenocarcinoma.

If we compare these figures with the total number of each variety of cancer, we find that in colloid cancer and in Paget's disease there were 100 per cent. cures.

In adenocarcinoma 66 per cent. cures; in scirrhus 43; in cancer 23, and in medullary cancer only 7 per cent. cures.

Thus it appears that the most favorable diagnosis is that of colloid or of Paget's disease of the nipple, and that adenocarcinoma comes next. These, however, are unfortunately rare forms of the disease. "Scirrhus" and "cancer" together constitute more than half the cases, and the percentage of cures in these two varieties combined is about 33. If, however, we combine all the varieties except "medullary," we have sixty cases with twenty-three cures, or 40 per cent. Unfortunately, the remaining forty cases, being medullary, have the small percentage of 7 in the list of cures.

The following table gives a summary of these percentages:

Percentage of Cures in Each Variety of Cancer.

Disease.	No.	Cures.	Percentage.
Colloid	2	2	100
Cancer	26	6	23
Scirrhus	28	12	43
Medullary	40	3	7
Paget's disease	1	1	100
Adenocarcinoma	3	2	66
	100	26	

Disease.	No.	Cures.	Percentage.
Non-medullary	60	23	38

Clinical Stages of the Disease.—The clinical course of the disease may be divided into three stages, which are sufficiently well marked from one another for the purposes of classification.

The first stage includes all cases in which the disease still remains practically in the condition in which it was when first discovered by the patient. This is characterized by the pres-

ence of a lump in the breast from one to two inches in diameter, and usually one or more perceptibly enlarged glands in the axilla.

As the figures show, this is of several months' duration, though it may last for several (three to four) years.

The second stage marks the beginning of the period of visible activity in the growth. The nodule which has remained for months quiescent begins gradually to increase in size, the skin to become adherent, and the glands to show themselves more plainly in the axilla. The patient now, for the first time alarmed, seeks advice. This accounts for the very large number of cases operated upon in this stage (between one-third and one-half of the total number). In the third stage are included all cases which have advanced beyond the immediate neighborhood of the primary focus, and have involved adjacent regions, either by direct extension or by metastasis. In such a category should be placed all cases which involve the whole breast or tissues contiguous to the mammary gland—such as the muscle, the skin, elsewhere than in direct contact with the growth, or the fasciæ—as well as the various metastases. Spreading of the infection to glands above the clavicle would alone constitute a condition necessary to place the disease in this class, even though the primary focus had changed but slightly.

Analyzing the cases on this basis, we find forty-five in the first stage of the disease at the time of operation. The number of cases cured in this class was nineteen. Thus it would appear that when the disease was operated upon promptly, we have as a result a percentage of cures as high as 42 per cent. But looking more closely into the duration of the disease before operation, we find that, of the forty-five cases of this class, in three only was it a question of weeks, and in these three cases there were no "cures." In twenty-eight cases the disease had existed from one to ten months, and here there were ten "cures." On the other hand, of the fourteen cases in which the disease had lasted over a year there were eight "cures." In one case the duration of the disease is not stated. We must

infer, therefore, that, although promptitude is all-important in surgical intervention, much depends upon the degree of malignancy of the growth.

Still, it is a consolation to know that we find cures even in the late stages of the disease, for in the second stage we have thirty-five cases with six "cures," showing that when the disease was operated upon in its second stage we had 17 per cent. cures.

There were nineteen cases that may be said to have been in the third stage with one cure, No. 81 (see below), or 5 per cent.

Summarizing these data, we have the following table:

Stage.	No. of Cases.	Cures.	Per Cent.
1	45	19	42
2	35	6	17
3	18	1	5

There were two cases in which death resulted from the operation, and which are therefore not included in this list.

Adherence of the Skin.—As the determination of a first or second stage is one which might vary with different diagnosticians, the forecast of any individual case could not always be so easy to determine by the aid of the above figures as by a consideration of the prognosis in the case of some very characteristic lesion, such as the adherence of the superjacent skin.

There were twenty-three cases in which the skin was adherent to the growth; of these

6 died within a year after operation;
5 died 1 to 2 years after operation;
1 died 2 to 3 years after operation;
4 died 3 to 4 years after operation;
1 died 5½ years after operation;
2 recurrences, 4 years after operation (now alive and well);
4 cures, 13, 10, 6, and 4 years after operation.

There are in this series about 17 per cent. cures. We may therefore say that adhesion of the skin diminishes by one-third the chances of cure. It should, however, be said that 26 per cent., or over one-quarter, of these cases are alive and well at the present time.

Axillary Infection.—In seventy-two cases enlarged glands were felt in the axilla. In seventeen cases there was no axillary involvement. In eleven cases no record was made. Of the seventeen cases in which there was no infection of the axillary glands eleven are cures,—that is, cures were effected in 64 per cent. of the cases in which no glands were felt.

Among the twenty-six recorded cures there are twelve cases in which there is a record of enlarged glands being felt in the axilla. In eleven cases no glands were felt, and in three no record is made.

Of the above seventy-two cases in which enlarged glands are recorded as present, there were eight in which glands were also felt above the clavicle. One of these cases died of the operation. Six died of recurrence, but lived on an average 19.8 months after the operation. One individual lived nearly three years after the operation. One is living with recent recurrence eight years after operation (Case 55). In all these cases a very thorough dissection of the posterior cervical triangle was made, but no permanent cure has been obtained.

ANALYSIS OF CASES CURED BY THE OPERATION.

A brief comment on each case cured is given below in order to bring out any peculiarities which may be recognized as contributing to the favorable result.*

* The terms used to designate the different types of cancer can be briefly explained as follows: Under scirrhus are classified those in which the connective tissue markedly exceeds the epithelial cells; under medullary, those in which the reverse is the case; under cancer, those where they are about equal. The adjuncts plexiform and adeno describe peculiarities in the arrangement of the epithelial cells. Illustrations of small (scirrhus) and large (medullary) plexiform adenocarcinoma are given in the microphotograph plate, Figs. 1 and 2.—(W. F. W.)

CASE 1.—This was a case of colloid cancer which had already existed three years and seven months previous to the operation; an enlarged gland was removed from the axilla five years after the operation. She is now alive and well sixteen years after the last operation.

CASE 2.—The diagnosis given in this case was "cancer." The duration of the tumor was uncertain. The patient was sixty years of age, and had a tumor the size of a walnut in the inner hemisphere; no infected glands were found in the axilla. It was probably what now would be considered a case of adenocarcinoma. The patient died of apoplexy at the age of seventy. She was stout and of plethoric habit. There had been no sign of recurrence.

CASE 3.—This was a typical scirrhus in a woman forty years of age. Duration of tumor one year. No glands were felt in the axilla, but one very small nodule was found after removal of the axillary contents. She is alive and well to-day, nineteen years after the operation.

CASE 4.—This patient was sixty years of age, and the tumor had been observed two months at the time of operation in 1885. The tumor was the size of a hen's egg and was in the upper inner quadrant. In 1894 a cancerous nodule was removed from the pectoral region, below and outside scar. She has been seen within a year; that is, ten years since the last operation, and is alive and well without recurrence. In this case microscopic examination showed masses of large epithelial cells in a stroma of connective tissue. "Cancer."

CASE 5.—A case of "cancer" in a woman sixty-five years of age. Duration of tumor, two months. There was considerable glandular infection, and I regarded the prognosis at the time as unfavorable. She died in mid-summer, six years later, at the age of seventy-one, of "sporadic cholera," and never had any sign of recurrence.

CASE 9.—The patient was thirty-eight years of age, the duration of the tumor six months, and the diagnosis was "scirrhus." The growth in the breast was the size of a walnut, and there was one infected gland in the axilla. She was examined repeatedly by me, and no sign of local recurrence was found. She was reported by her physician to have died of pulmonary hæmorrhage fourteen years after operation, and that this in his opinion had no relation whatever to a recurrence of the original disease. Micro-

scopic examination. "A dense retracting mass showing small nests of epithelial cells in the midst of firm connective-tissue stroma. The scraping from the gland showed an occasional epithelial cell."

CASE 14.—This was a woman fifty years of age with a tumor of six months' duration. It proved to be a case of cancer developing and spreading from the walls of a cyst. The patient was last heard from five years after the operation, and was alive and well at that time.

The following is Dr. Whitney's report:

"The whole gland is replaced by a dense white tissue in which were several cavities, the largest as big as a robin's egg. These were lined with a smooth membrane and had evidently contained fluid. On microscopic examination the basis of the growth was found to be composed of a dense fibrous tissue. In this were embedded the altered glandular elements. In places the ducts were dilated, evidently the origin of the large cysts seen in gross. Here and there the acini of the gland were reduced in size and the cells smaller as if undergoing atrophy. In other places the cells had proliferated, and extended widely from their original place in a plexiform net-work into the surrounding tissue. In places the lines of cells appeared to follow the lymphatics; here and there a compound granular cell, and in general, a decided tendency to fatty degeneration.

"The growth seems to be a diffuse interstitial fibroma in which the gland elements are now beginning to proliferate actively (commencing cancer)."

CASE 19.—The patient was fifty-one years old; the disease had existed seven months. The microscopical diagnosis was "cancer," and the glands in the axilla were found non-infected. The patient is alive and well thirteen years after operation. The nodule when examined was the size of a walnut in the upper outer quadrant deep in the substance of the breast. The cut surface was marked by yellowish opaque lines and dots. Under the microscope there was a dense connective-tissue stroma with relatively small masses of cortical epithelium in the spaces. The glands were enlarged, but in the one examined there was no distinct nodule of new growth.

CASE 20.—Fifty-two years of age; duration of disease, twenty months. The mass is described in the report as the size

of a small orange in the upper inner quadrant; glands in the axilla involved. She died of "grippe" thirteen years after operation. Pathological report. "A large, dense nodule deep in the breast with a radiating appearance, and the surface marked by yellow opaque lines and dots. Microscopic examination showed masses of cubical gland cells deep in the connective tissue. Cancer."

CASE 35.—Sixty years of age. Duration, thirteen months. Hard tumor size of hen's egg movable on muscle; skin adherent. A chain of glands running high up was found in the axilla at operation. The diagnosis was "cancer." Alive and well eleven years after operation. Microscopic examination. "A large nodule extending quite through the thickness of the breast, showing masses of epithelial cells in a stroma of vascularized connective tissue. The axillary glands were infected with a growth of similar character."

CASE 38.—Thirty-five years of age. Duration of growth, five years. Tumor size of goose-egg. Diagnosis, "cancer." Alive and well eleven years after operation. Microscopic examination. "Nodule size of an egg in the periphery of the breast and adherent to it, but not to the skin. The section surface was grayish, slightly translucent, and thickly covered with small, opaque, yellow spots from the size of a pin's point to a pin's head. This on microscopic examination was found to be made up of solid masses of epithelial cells lying in a connective-tissue net-work." Axillary glands were infiltrated with a similar growth.

CASE 39.—Fifty years of age. The duration was known very accurately in this case, as patient (whose mother had died of cancer) had been warned to be on the lookout at same age. The operation was performed within the month. Two small nodules the size of a pea were found in the breast, and one gland about one-third of the size in the axilla. The diagnosis was "scirrhus." Alive and well eleven years after operation.

CASE 42.—Sixty years of age. Disease of two years' duration. Nodule in skin on axillary border over upper and outer quadrant; a few glands felt in the axilla. Died of pneumonia ten years after operation. This type has been described by me as "cancer of the axillary border;" (*Boston Medical and Surgical Journal,* November 12, 19, 1896, and January 21, 1897; Inter-

national Text-Book of Surgery, Vol. ii, p. 280; Hektoen, Text-Book of Pathology, p. 1089;) and if untreated runs the typical course of cancer of the breast. In this respect it resembles closely Paget's disease of the nipple.

Case 44.—Fifty-three years of age. Duration, three months. Mass size of walnut; no glands felt. Diagnosis, "scirrhus." Alive and well ten years after operation. No swelling or restriction in the use of arm (a frequent report in reply to questions on this point in other cases). Pathological report. "A very small, dense, retracting nodule just beneath nipple, containing masses of epithelial cells in a dense connective-tissue net-work."

Case 54.—Forty-five years of age. Duration, five months. This was an excellent example of cancer originating in an involution cyst. The following is Dr. Whitney's report: "The tumor was a large, diffused mass more or less opaque, dotted with yellow lines in the midst of a fibrous, thickened gland with numerous cysts small in size. Microscopic examination showed the growth to be made up of small, solid masses of epithelial cells in the midst of a connective-tissue stroma. The axillary lymph glands were slightly enlarged, but as far as could be determined were not invaded by the disease. The diagnosis is a scirrhus cancer originating in a diffuse fibroma of the breast with retention cysts."

Case 59.—Forty-nine years of age. Duration not stated. There was a small, dense, fibrous retracting nodule the size of the tip of the finger deep in the breast tissue. Microscopic examination showed masses of rather small, irregular epithelial cells separated by a dense stroma of fibrous tissue. The axillary glands were infiltrated with a similar growth, but those at the highest point of the tissue removed both in front and behind the great vessels were normal. The diagnosis is "scirrhus."

The patient is alive and well nine years after operation.

Case 60.—Sixty-six years of age. Duration, three years. Diagnosis, "atrophying scirrhus." Small gland felt in axilla. Died of paralysis eight years after operation, at age of seventy-four. During the intervening period had frequently reported, and was known to have been perfectly well.

Case 64.—Sixty-three years of age. Duration, seven months. Mass size of lemon in upper outer quadrant. No glands felt in axilla. Pathological report. "Nodule fibrous and infiltrated with

relatively large areas of opaque puriform-looking material in the substance. The microscope showed masses of epithelial cells, large and irregular, undergoing a rapid fatty degeneration, separated by a stroma of connective tissue. Neither by the eye nor by the microscope was there any evidence of a new growth in the glands." "Medullary cancer."

Case 66.—Fifty-eight years of age. Duration, six months. Diagnosis, "medullary cancer." Nodule in upper-inner quadrant, size of horse-chestnut; few slightly involved axillary glands. (Recent study of the specimen by Dr. Whitney shows a pseudo-alveolar formation; no infiltration of surrounding tissues; no invasion of lymph nodes. Diagnosis, adenomedullary type.) (Fig. 1.)

Case 76.—Fifty-one years of age. Duration, ten months. There was a mass the size of a walnut in the upper inner quadrant occupying the entire thickness of the mammary gland and a small nodule in the pectoral muscle. The axillary glands were not implicated. A recent study of the specimen by Dr. Whitney classifies it as an adenoscirrhus. (Fig. 2.) "The growth was composed of masses of small epithelial cells in a close plexiform arrangement in places, with a distinct gland-like arrangement about a central opening. These could be followed in the connective tissue between large and small bundles of muscular fibres."

Case 77.—This patient was seventy-three years of age and had myxœdema. The wound healed slowly, but without sepsis. She died of croupous pneumonia four years after the operation. Microscopically, there were small alveoli close together, the same condition in the lymph-glands. Diagnosis, adenoscirrhus. There was a hard nodule about three centimetres in diameter, beneath a retracted nipple, in a large breast.

Case 79.—Sixty-five years of age. Duration, two years. Colloid cancer originating from an involution cyst. No glands felt. "Retention cysts with mucous degeneration of the stroma of cancer, which was of the small plexiform scirrhus type."

Case 81.—Forty-six years of age. Duration, twenty months. "Medullary cancer with cystic degeneration." Tumor was a large nodule about six centimetres in diameter close to the nipple and adherent to the skin, which was reddened. The centre of the nodule was occupied by a cystic cavity about three centimetres in diameter. The aspect of the surface was grayish and

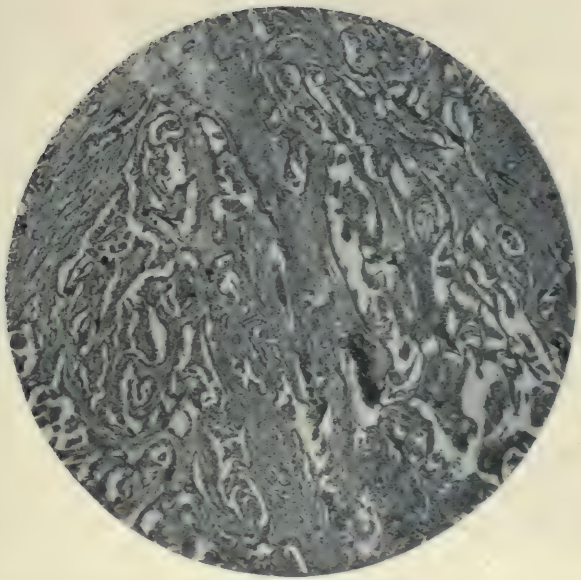


FIG. 1.—Large plexiform adenocarcinoma ("adenomedullary"). Case No. 66.

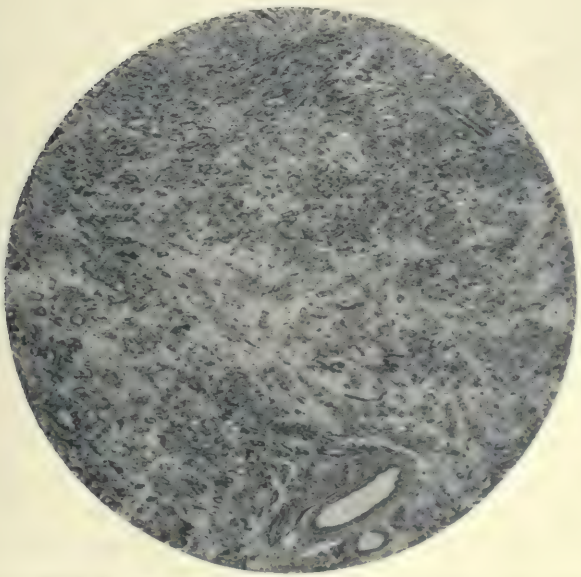


FIG. 2.—Small plexiform adenocarcinoma ("adenoscirrhus"). Case No. 76.

medullary. Microscopically there were large, solid masses of epithelial cells separated only by bands of fibrous tissue. These cells had a marked tendency to softening, and in places were only left intact in close proximity to the vessels. In other places the cells had apparently grown into and filled small cystic cavities (of which there were numerous ones in the immediate vicinity of the growth), making a coarse plexiform arrangement. Everywhere in the gland tissue there was a slight tendency to proliferation of the epithelium. There were eight or ten lymph nodes in the specimen, many of which were infected, but the node from the highest point in the axilla as well as those above the clavicle did not show any infection.

Case 93.—Thirty-one years of age. Duration, eight weeks. Mass size of plum under nipple. Nipple retracted. No glands felt. Small plexiform adenoscirrhus. (Fig. 2.) Lymph nodes the same. Diagnosis, adenocarcinoma.

Case 97.—Sixty-three years of age. Duration, two years. There are several small nodules varying from one centimetre to three centimetres in diameter in the mammary gland. One of these in the line of a cicatrix of an old abscess many years before. There was a tendency to form dense fibrous tissue in all these nodules. In the axillary fat one rather large and two small exceedingly hard lymph nodes were found. Under the microscope the main growth was made up of small, solid masses of epithelial cells, separated in places by a meshwork of dense fibrous tissue of varying thickness. In places this could be seen extending along the outside of the smaller ducts.

Case 98.—Forty-four years of age. Duration, nine years. Diagnosis, Paget's disease. No axillary involvement. The downward growth from the rete could be distinctly followed microscopically.

A study of these cases seems to show in the majority some peculiarity throwing light upon the favorable issue. Nearly one-half were typical scirrhus (see list above). Several (four) originated from involution cysts. In another case my early diagnosis (three days) seemed to contribute to the favorable result. The case of Paget's disease and those which I have termed "cancer of the axillary border," where the disease also begins superficially and spreads ultimately into the mammary

tissue, seem also examples of a favorable type; yet there is one of this latter type in the list of deaths with metastases in the spinal column, showing it to be a true "cancer of the breast." That youth is not always a sign of unfavorable prognosis, Case 9 is proof, the age of the patient being thirty-eight years.

It is encouraging to see several distinctly unfavorable types of the disease in this list of cures, such as Case 5, about which I was at the time of operation quite despondent; Case 35, where the skin was adherent to the growth; and Cases 66 and 81, which were examples of medullary cancer.

In a recent study of the specimens of several of the above cases, Dr. Whitney finds two which are of a distinctly unfavorable type. In Case 81 all the marks of a rapidly growing cancer were present. In Case 77, although of a more fibrous type, with relatively small cells in small plexuses, still, the axillary infection was very marked, and many small vessels in the surrounding fat tissue were filled solidly with cells. Whether these were small veins or lymphatics with thickened walls was hard to determine; in either case it added to the gravity of the prognosis, as, when once the disease is in the veins, metastases in distinct organs are rarely absent.

Recurrence.—The date of death is known in sixty-one of the cases in which death from recurrence occurred. In these sixty-one cases the average duration of life after operation was two years and one month.

In fifty-two cases the date of appearance of recurrence is noted. The average space of time was one year and ten months after operation.

This series includes Cases 1 and 4, in which there were late recurrences, but which are now in the list of cures, and Cases 55, 56, 74, 84, 89, 92, and 94. These patients are now either living with recurrence or have had recurrent growths removed within three years.

Excluding these nine cases, there are left forty-three cases in which death occurred from recurrence, the date of the recurrence being known. It averaged in these forty-three cases one year and two months after operation. In the nine cases

(two cures and seven living, with history of more or less recent recurrences), the average duration of time was much longer, being five years and five months after operation.

Of the sixty-one cases in which death occurred from recurrence of the disease, 7 died before 6 months, 8 between 6 months and 1 year, 22 between 1 year and 2 years, 12 between 2 years and 3 years, 5 between 3 years and 4 years, 2 between 4 years and 5 years, 2 between 5 years and 6 years, 1 between 6 years and 7 years, 1 between 7 years and 8 years, 1 between 8 years and 9 years.

The greatest mortality is at the period ranging from eighteen months to three years after operation.

Of the sixty-one cases, it will be seen that there are twelve, or 19 per cent., which have died after the three-year limit. After a period of five years has elapsed the percentage is as low as 8, and it is not until nine years have elapsed that no deaths are found in the list. These figures show that the three-year limit does not by any means constitute an infallible test of cure.

Returning now to the nine living cases in which there is a history of recurrence, we find two that are "cured," having gone respectively sixteen and ten years since the last operation. The following is a brief statement of the peculiarities of the remaining seven cases.

Case 55 (aged fifty-six years at time of operation) is now alive at time of writing, with symptoms of recurrence in shape of pleurisy and enlargement of the upper end of the sternum and a nodule in the pectoral region, all having appeared within a year, that is, eight years after the operation (January, 1895). This was a case of medullary cancer originating from a cyst with axillary and supraclavicular infection. At the operation the clavicle was divided and the cervical region thoroughly dissected. I had regarded this case until now as the only "cure" in cases where the supraclavicular glands had been found involved.

Case 56.—This patient, forty-five years of age and suffering from scirrhus, had a "recurrence" in the other breast almost eight years after the operation. The breast was removed by a surgeon

in Shanghai, and she is now alive and well, about a year and a half after the second operation. Was this to be regarded as a recurrence or as a new infection?

CASE 74 (fifty-six years of age) was a medullary cancer taken early and while the growth was small. An operation was performed in Tokio by a Japanese surgeon on account of the appearance of the disease in the opposite breast, nearly five years later. There was no recurrence in the first operation scar. At last accounts she was failing.

CASE 84.—This was a case of scirrhus with infection of the axillary glands in a woman forty-seven years of age. The operation was performed in April, 1899. A nodule was removed in August, 1902, from the pectoral region, and a section of the second rib was removed in January, 1903. Since then there has been no sign of disease.

CASE 89.—Sixty years of age. Duration, one year. Mass size of egg in lower outer quadrant; two areas of infected skin size of three-cent piece below and inside nipple. No glands. Operation, October, 1899. Small nodule removed from pectoral region by Dr. Odiorne in October, 1903. Alive and well at present time. Disease, scirrhus.

CASE 92.—Sixty-one years of age. Duration, eighteen months. Mass size of egg in upper outer quadrant. No glands. Operation, November, 1899. Nodule removed from scar in pectoral region by Dr. W. B. Odiorne in July, 1903.

CASE 94.—Patient, thirty-six years of age. Duration, two and a half years. Mass size of walnut in scar of an incomplete operation seven months before. Adherent to ribs. Diagnosis, adenocarcinoma. No recurrence for three years, when disease reappeared in cicatrix. No secondary operation has been performed.

It will be seen that four of these cases are alive and well at the present time, but as none of them has gone through a period of more than eighteen months since the last operation, they cannot be regarded as cured.

They are all cases, however, which furnish ample justification of the operation performed, for in two cases there was a respite of eight years from disease, and in one of five years; and one of these patients is alive and well nine years after her

first operation. Another is now alive and apparently well five years after her first operation in spite of two recurrences.

In two of these cases the disease reappeared in the opposite breast. This locality of recurrence, if we consider it a recurrence, was found in eight cases of the entire 100 cases, but in only one other beside the two mentioned was there an independent development of the disease in the opposite breast, there being no sign of a return in the operation scar. The comparatively frequent association of disease in the opposite breast with recurrence in the side originally affected, as shown in Cases 26, 27, 69, 90, and in Case 40, where both breasts were affected simultaneously, makes it seem highly probable that these are not examples of so-called "new infections," but that the breast must be regarded as in the same category with the brain, the uterus, and other distant regions such as the bones of the inferior extremity, which, although not in the direct track of the disease, occasionally become infected.

Palliative Operations.—There are fourteen cases in which the disease may be considered to have advanced so far that a radical cure could not be expected; but these cases were all given a chance, as the new operation might give a long respite, if not an occasional cure, such as we have seen in one case at least in the third stage of the disease reported above. (Case 81.)

These cases may be briefly noticed to show their general character. In Case 6 the skin was involved, and there were roselike outgrowths, and the glands in the axilla were the size of a lemon. Recurrence, however, did not take place until two and one-half years after operation, and the patient lived nearly three years.

Case 7.—Brawny infiltration of breast with pregnancy; death three months later.

Case 13.—Tumor size of cocoanut. Skin adherent; death in six months.

Case 18.—Tumor size of an apple, with glands above clavicle. Recurrence in eleven months; death two years after operation.

CASE 24.—Tumor size of orange; skin adherent and ulcerated; the glands are adherent to the axillary vessels. Death eighteen months later.

CASE 30.—The disease involved the whole breast; offensive ulceration; the axilla was filled with infected glands; but the patient lived over eight years. At the autopsy, the lungs, pleura, chest wall, liver, and long bones were found involved.

CASE 32.—General involvement of breast. Orange skin. Death in six months.

CASE 61.—Puerperal cancerous mastitis. Death in three months.

CASE 67.—Primary nodule adherent to skin and muscle. Nodules in skin. Glands in axilla. Death in fourteen months.

CASE 73.—Whole breast involved and enlarged glands above clavicle. Died of pulmonary embolism five days after operation.

CASE 75.—Tumor size of cocoanut. Axillary glands could not all be removed. Died in fourteen months.

CASE 85.—Could not all be removed; died within the year.

CASE 90.—Orange-skin breast. Glands above clavicle. The patient lived nearly three years, for two of which she enjoyed excellent health.

CASE 94.—Operation for recurrent disease following an incomplete operation seven months before. Adherent to ribs. Adenocarcinoma. Recurrence three years later.

I think it is fair to assume that in none of these cases had the surgeon any right to give hope of cure, and yet one lived two years, three lived three years, and one died eight years after operation. In this latter case there was an offensive ulceration from which she was entirely relieved, the patient dying of internal metastases (Case 30).

Such a case as this is an encouragement to the surgeon to attempt relief under most discouraging circumstances.

Situation.—A record of the situation of the disease has been kept in seventy-four cases, as follows: Upper outer quadrant, 17; centre of breast, 12; upper hemisphere, 10; lower outer quadrant, 8; upper inner quadrant, 7; whole breast, 7; outer hemisphere, 7; lower hemisphere, 3; lower inner quadrant, 1; inner hemisphere, 1; axillary border, 1.

The disease was more frequently observed in the upper hemisphere than in the lower; in the outer hemisphere than in the inner hemisphere; and in the upper outer quadrant than in any other quadrant.

Looking over the list of cures with reference to the situation of the growth, we find an accurate statement in eighteen only. Among these, in five the growth was somewhere in the inner hemisphere, in four somewhere in the outer hemisphere, in five somewhere in the upper hemisphere, and in three in the central region of the breast.

Inasmuch as only nine cases are stated definitely to have been in the inner half of the gland, it is evident that the percentage of cures is much higher in this hemisphere than in the outer.

Duration of Disease.—Although we have stated elsewhere that the percentage of cures is much higher when the disease is operated upon in its early stages, a study of the duration of the disease before operation does not appear to bear out this view. The average duration of the disease in the 100 cases was 11.8 months before treatment, but the average duration in the twenty-six cured cases was 12.3 months. Here we find a longer interval had elapsed before operation in the successful cases; this can probably be explained by the supposition that the disease in these cases was of a milder character and remained for a longer time in the primary stage.

Retraction of the nipple was recorded in twenty-two cases.

Operation.—The operation which was performed in the first fifty cases consisted in a removal of the breast and pectoral fascia and a dissection of the axilla. In the second fifty the "completed" operation, as it is now understood, was performed, both pectoral muscles being removed, the clavicular portion of the pectoralis major being left behind, and the posterior cervical triangle frequently dissected. Lately, it has been my habit to omit the dissection of the triangle in case microscopic examination of the higher axillary glands shows that the limit of infection has been reached.

It may be worth noting at this point that the results of

operation in these two series of fifty cases show a slightly greater number of cures where the lesser operation had been performed. In the first fifty there were fourteen cures, and in the second fifty only twelve.

This was due to the fact that Cases 1, 2, 3, 4, and 5 were all cures; but, allowing for this unusually fortunate series of consecutive cures, we do not find any striking differences in the results of the two methods.

In the greater portion of the second series the method known as the Halsted operation was conscientiously followed. Latterly, however, *i.e.*, during the past year, I have adopted the method given below, and find it one that I can recommend as both safe and thorough. Safe, because—following as it does anatomical lines—the vessels are divided at their point of origin at the beginning of the deep dissection, and hæmorrhage is thus controlled without unduly prolonging the operation, while the greater portion of the wound is not exposed until the close of the operation. Thorough, because it permits of a free exposure and dissection of the axilla up to the point of the disappearance of the axillary plexus of lymphatic glands beneath the clavicle before the mass to be removed has been dislodged from its attachments and allowed to interfere with the anatomical relations of the parts.

An "anatomical operation" for cancer should of course only be so far permitted in that it facilitates the freest possible removal of the diseased parts. It should always be remembered that the indications are in cancer to stamp out the disease. All other considerations which enter into so many other operations should be disregarded, with the single exception of the safety of life. Anatomy and æsthetics should always play a secondary rôle. This having been conceded, there is still much that can be done to make the operation less exhausting and disfiguring than some of the "completed methods." It should be said here, however, that the modern operation, as now performed by the most conscientious surgeons, is always to be preferred to the feeble imitations that one often sees, even at the present time, in hospital practice.



FIG. 3 shows the amount of skin included in the racket-shaped incision; also the flap which is diminished in appearance by perspective.

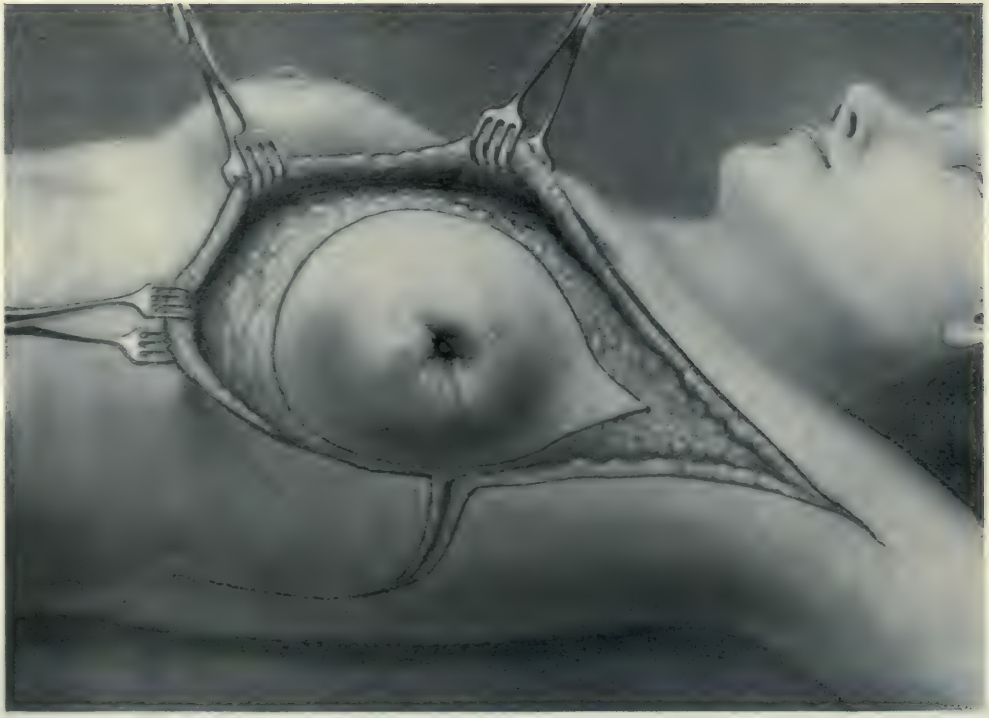


FIG. 4.—Preliminary dissection of the integuments in all directions, leaving a pyramidal mass of tissues to be removed, of which the primary nodule is the apex.

The steps of the operation, as I have performed it, are as follows:

An incision is made from the anterior and outer margin of the axilla running a little above its upper border and the line of insertion of the pectoralis major muscle around the lower border of the breast to a point on the boundary line of the inner and lower quadrant. If there is serious doubt as to the malignant nature of the growth, the breast can be lifted up from below by carrying the dissection of the last half of this incision more deeply, and exploring the mammary gland on its posterior surface. Otherwise a second incision is made beginning at the middle of the anterior axillary fold, gradually diverging from the first incision as it approaches the breast and, sweeping around the upper and inner margin of the organ, meets the first incision at its terminal point. This may be called the preliminary racket-shaped incision. (Fig. 3.) The operator should not tie himself down too rigidly to these landmarks, but the circle should be described around the primary nodule, as nearly as may be, as a central point.

Before proceeding to the second step of the operation, a flap should be marked out on the outer side of the pectoral region. To do this, the knife divides the skin above the middle of the first incision, *i.e.*, on the outer edge of the wound, on a line drawn first at right angles to said incision and gradually sweeping round until it becomes parallel to it and terminates at a point a little below the level of the lower margin of the wound. (Figs. 3 and 4.) This flap is intended to be turned into the lower portion of the wound. Formerly, I made two such flaps, one above and one below, but now find the method of closing in the wound described below to be preferable. The present flap is therefore made longer than the one described in my earlier operations.

In case there is infection of the cervical region, an additional incision should be made from the middle of the upper half of incision number two along the posterior border of the sternomastoid muscle to expose the clavicle and the posterior cervical triangle. This incision, if necessary, is, however, not to be made until a later stage of the operation.

The second step of the operation is the dissection of the integuments freely on all sides, the axilla included, from the subjacent adipose tissue. The axillary skin and the flap are thus dissected off on the outer and lower side of the wound, and the dissection on the median line is carried well over the margin of the sternum. (Fig. 4.)

Above this superficial dissection should be carried up so as to expose the clavicle. When the skin is reflected back on all sides, a cone with a broad base is exposed, the apex of which is the nipple, and which is composed of the breast, the pectoral muscle, and the surrounding adipose tissue. (Fig. 5.) The removal of these structures *en masse* constitutes the third stage of the operation. This is done from without inward in a direction exactly opposite to that carried out in the Halsted operation, so that the entire mass to be removed is thrown towards the median line.

Beginning with the humeral insertion of the pectoralis major muscle, the forefinger of the left hand of the operator is slipped under the edge of the muscle from above downward and the muscle is divided a short distance from its insertion. (Fig. 5.) The proximal end of the muscle is seized by hooks and pulled in the direction of its origin, while its fibres are separated from those in immediate contact with the clavicle. An assistant while holding the hooks gently draws the breast with the other hand in the direction of the epigastrium. A few touches of the point of the knife expose the insertion of the pectoralis minor muscle. The finger is now hooked under this insertion and the muscle divided. (Fig. 6.) When the assistant retracts the breast in the direction already indicated, the axillary region is freely exposed, and the thin fascia overlying the vessels being divided, the larger vessels are readily identified. In this way the dissection of the axilla can be carried out with great precision, and the origin of all the large branches can be secured with the ligature. (Fig. 7.)

Too great care cannot be taken in this dissection, and the various processes of adipose tissue must be sought for and turned back upon the mass to be removed. As the main branches are



FIG. 5.—Exposure of the insertion of the pectoralis major. The knife is about to divide the muscle at this point. The latissimus dorsi is also exposed, showing the limit of the dissection outward.



FIG. 6.—Division of the insertion of the pectoralis minor muscle.

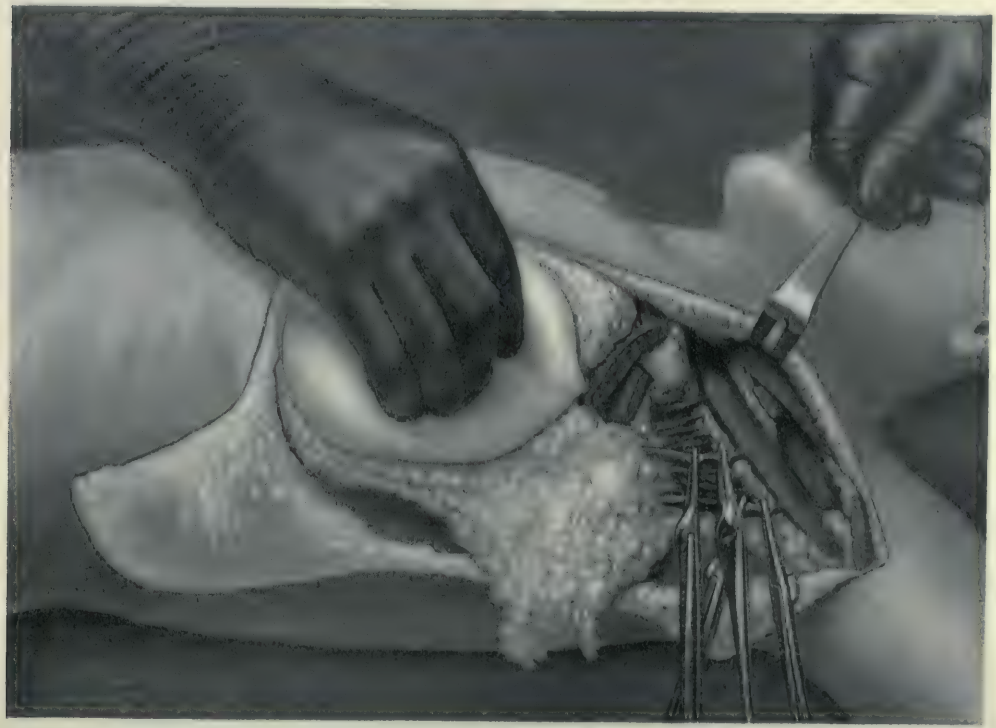


FIG. 7.—The divided muscles permit the retraction downward and inward of the breast and axillary contents and enable the operator to expose freely the axilla and to tie the main branches at their origin.

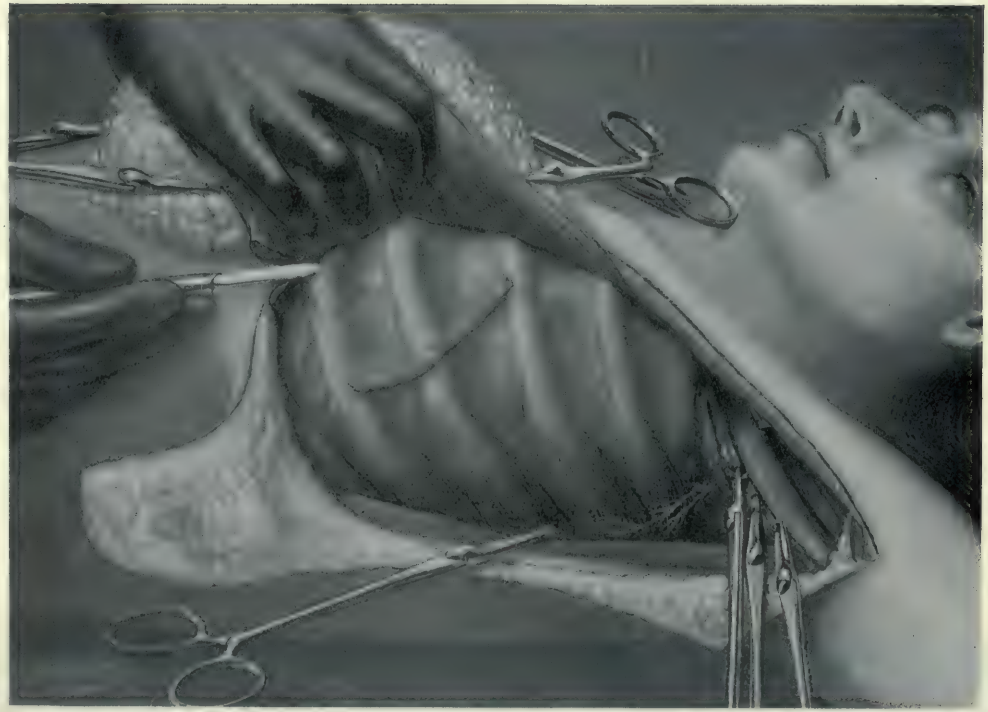


FIG. 8.—The mass to be removed has been reflected towards the median line; the origin of the pectoralis minor has been divided and the origin of the pectoralis major is being divided as the final step in the operation. The large wound is thus uncovered only at the last moment.

divided, the dissection can be carried both inward and outward with more freedom, thus allowing the breast to slide gradually inward and downward.

As the dissection of the axilla approaches the clavicle, care must be taken not to cut through the superjacent fat that has been exposed by the earlier dissection, but to reflect it back in every direction towards the centre of the mass, so that the upper edge of the origin of the pectoralis major at the sternal margin is clearly identified. As the dissection proceeds downward and outward in the axilla the adipose tissue must not be divided until the knife can come down upon the latissimus dorsi muscle. (Figs. 5 and 6.) The greatest care must be taken not to separate any of the tissues from the included lymphatic glands or to cut into them. No attempt should be made to save vessels or nerves in the axilla, but the great plexuses must of course be treated without roughness, and there is no necessity for wounding them. Division of the axillary vein has been found necessary in only one instance, and the patient suffered no great inconvenience; but operations in which such radical measures are necessary can be looked upon only as palliative, the disease being advanced too far to admit of a radical cure. At least this is my experience. A slight wound of the axillary vein is easily controlled by catching up the bleeding point with blunt forceps and passing a fine silk ligature around it.

A few sweeps of the knife separate the mass from the latissimus dorsi muscle. The breast is now seized by the operator and rapidly dissected off the thoracic wall from without inward. The origin of the pectoralis minor is first divided, and the final act of the operation consists in severing the origin of the pectoralis major while the breast and attached tissue are firmly held away from the sternal margin. (Fig. 8.)

The time occupied with these three stages of the operation should not exceed forty minutes, and usually thirty minutes are sufficient.

The hæmostatic forceps are now disentangled and each vessel tied with fine silk. I find this material on the whole most satisfactory for the operation, and have experienced no incon-

venience from ligature sinuses. Silk seems to be readily disintegrated and absorbed in this region. Meanwhile the specimen has been handed to a pathologist, and the condition of the peripheral portions carefully investigated. Particular attention should be paid to the most distant glands, and if the report comes back that those near the vessels as they run under the clavicle are infected, the posterior cervical triangle should be exposed. The incision to be made for this purpose has already been described.

After cutting through the deep layer of the superficial fascia of the neck, the posterior border of the sternomastoid is pulled inward and the omohyoid is lifted upward. A thin fascia then presents itself, under which lies a pad of adipose tissue, in which one or more lymphatic glands are found. It is this group which is continuous with those in the upper axillary region and which is first to become infected. (Fig. 9.)

At one time I made this dissection a routine feature of the operation, but, after finding them in the great majority of cases non-infected, I reserve this dissection for those cases only in which there are well-marked indications.

The pad of adipose tissue should be freed as much as possible by blunt dissection, and all bleeding points carefully secured as the operation proceeds.

When the region has been properly cleaned out, it is possible to make the forefingers of each hand come in contact with one another beneath the clavicle. In a few cases I have divided this bone, but do not find that any additional advantage can be gained by this procedure.

I have referred above to a case where this bone was divided in order to remove glands above the clavicle. (Case 55.)

The patient is now slowly succumbing to the disease, eight to nine years after the operation, with infection of the sternum and pleura; but there is no return in the cervical region. Such cases go far to show the very serious prognosis that must be given when the cervical triangle has been invaded.

The closure of the wound in this operation has always been a difficult problem, since it has been decided that the whole in-

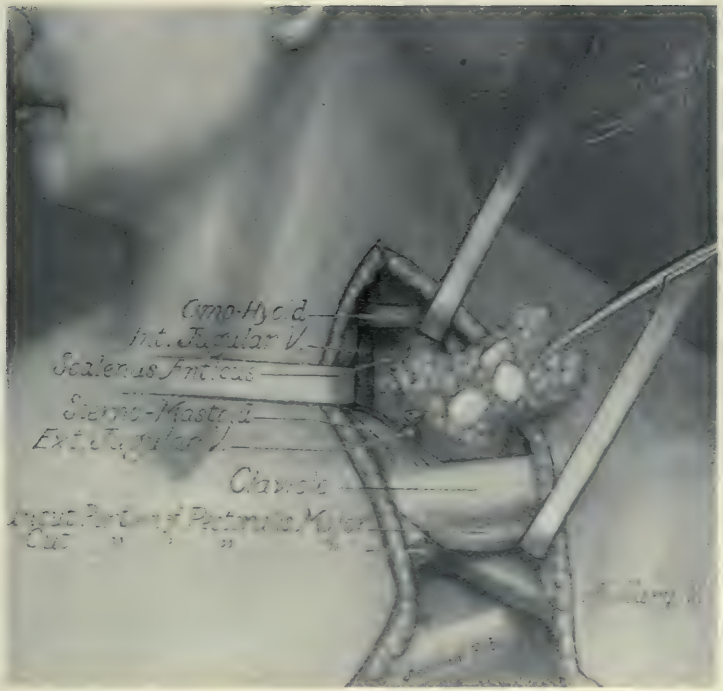


FIG. 9.—Dissection of pad of fat containing three infected glands from subclavian triangle. The sternomastoid muscle being drawn inward exposes the internal jugular vein. Note the scalenus anticus muscle upon which this pad rests. The glands with the surrounding adipose tissue can be readily stripped from the muscle by a blunt dissector. The external jugular vein or a branch of it is usually tied.

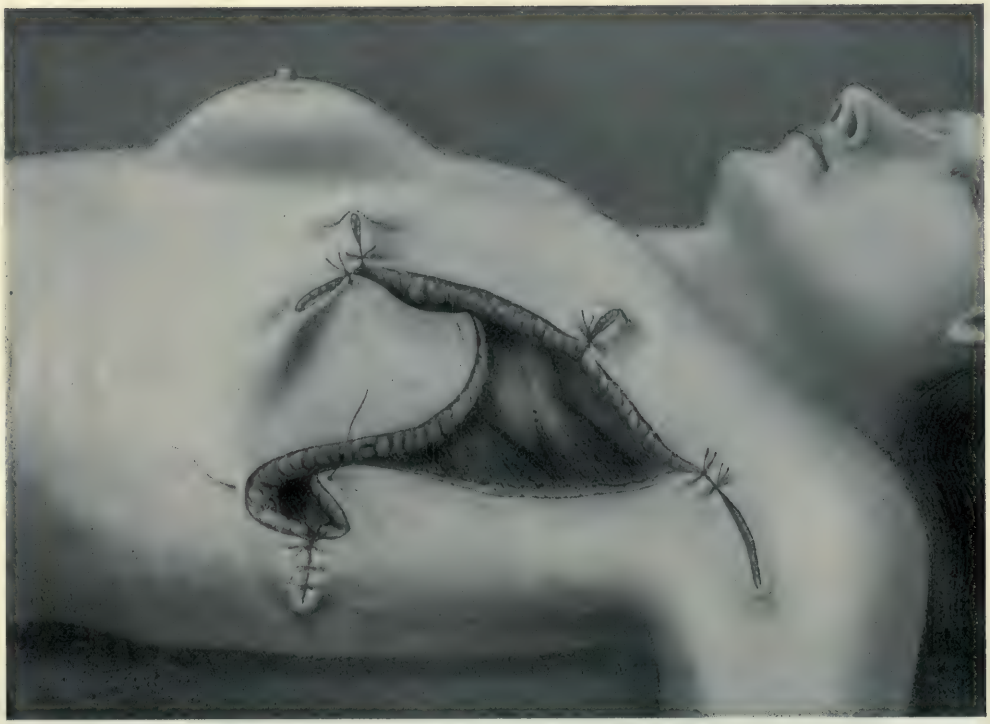


FIG. 10.—Mode of closing the wound. *A*. The flap has been turned in and caught with one suture. It is gradually being pushed into position by peripheral sutures. *B* shows how the upper half of the outer edge of the wound is slid under the lower half or flap. Note the shortening of the long axis of the wound by the stitching on the inner border.

tegument of the breast should be included between the incisions. Any method which permits of an easy approximation of the edges of the wound is out of date.

The method of grafting adds materially to the length of the operation and leaves a most unsightly scar. The removal of the breast is at best a demoralizing ordeal to most patients, and every effort should be made to procure as rapid healing and as little unsightly a cicatrix as possible.

So far as the scar itself is concerned, this difficulty is overcome by dissecting the opposite breast away from its attachments to the pectoral muscles and sliding it over to the median line, thus closing the wound without tension. The result is one, however, which produces a deformity of outline which is hardly likely to make this method popular with patients.

The lower portion of the wound is the part where the edges are the most difficult to approximate. The free loosening up of the skin enables the upper portions to come easily together.

The flap made at the outer side of the wound is about the size of the human hand, and when first turned in seems to be totally inadequate for the purpose. To draw upon this flap is to endanger its vitality. For this reason I begin suturing on the outskirts of the wound at four different points, viz., at each end and on each side. A few stitches should be taken at the axillary and at the sternal ends of the wound first. The flap is then turned in (Fig. 10) and held in place by a temporary stitch, while it is gradually *pushed* up into place from below by sutures firmly girding together the edges of the skin to which the flap was originally attached. Thus it gradually comes about that the point *B*, which was originally in contact with point *A*, is rolled in underneath the flap and forces it into position. Sutures should all be superficial, as deep sutures cut and do not give the skin included by them a chance to stretch. In order to enable the edges to come together easily, it should not be forgotten that it is necessary to dissect up the skin for a considerable distance in every direction. This is what the first stage of the operation attempts to accomplish, while it at the same time makes the operation all the more radical. In stout patients the

cavity of the wound is easily closed, but the problem is more difficult in thin individuals. Experience only will enable the operator to determine how much tension can be put upon the flap in inserting the final stitches. In doubtful cases there is no objection to leaving them untied, as the opening thus left serves admirably for drainage. In many cases this opening can be closed by secondary suture a few days later, or it may be allowed to heal by granulation. A small graft may be used to facilitate the process, and I have occasionally resorted to this plan, but rarely find that the granulating wounds are sufficiently large to make such a method desirable.

Fig. 11 shows the wound as finally closed, one or two sutures remaining untied indicate that these are the last to be tied. The position of the drainage gauze—a short and small wick—is indicated. The wound should be dressed at the end of twenty-four hours, and the wick should then be removed.

Mortality.—In this series of 100 cases there have been two deaths from the operation. One was from acute septic infection, due apparently to the fact that the patient had been put in the bed previously occupied by a case of erysipelas. The second case was one of pulmonary embolism caused by allowing the patient to sit up too soon and move about too freely after the operation. Since this experience, I have been in the habit of keeping patients in the recumbent position for one week after the operation, thus allowing time for any thrombus that may have formed to become firmly attached to the vessel wall.

A final word about cancerous infection during the operation. Whether or not there is a possibility of such an occurrence does not seem to me to be fully determined by any data now in our possession. There are, however, some very suggestive experiences familiar to all where exploratory incisions have apparently led to an extension of the disease.

It is my habit to act upon the supposition that such danger exists, and throughout the operation to attempt to keep the parts exposed protected as much as possible by gauze packing. The operation which I have described has this advantage, that nine-tenths of the wound is not exposed, or in fact touched by an



FIG. 11.—Final adjustment of the flap. Note the relative positions of *A* and *B*. The final sutures are still to be tied. Note the position of the gauze drain, which is left in twenty-four hours.

instrument, until the close of the operation, presenting, therefore, much less danger of such infection than wounds that may have been wide open for hours.

In exploratory incisions such as I have described, instruments should be changed, and the wound leading to the disease temporarily closed by suture or packed with gauze, so as to protect the operation wound as thoroughly as it is possible to do under the circumstances.*

* A portion of this series, consisting of seventy-two cases, was published in the *Boston Medical and Surgical Journal*, August 25, 1898. Two new cases have since been inserted in this list, *i.e.*, No. 20, a "cure," and No. 30, a late recurrence. Twenty-six new cases have been added. Some details as to the history of the cases can be found in this article. With the slight changes above mentioned, the numbers correspond.

MODERN BULLET WOUNDS.

BY FRANK W. FOXWORTHY, M.D.,
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THE history of bullet wounds is being rewritten each day as the Russian-Japanese War progresses.

The experience on such a large scale gained in this war will settle the theories as to the effects of modern bullets which were advanced during the Spanish-American and South African Wars. The Filipino insurrection was but a transition period in which the effects of the old bullets could be contrasted with the new.

All the great powers have laid aside the soft lead, large-sized bullets used in the Springfield, Martini, and Remington rifles, and are now using the small caliber, nickel-jacketed bullet with smokeless powder. And though the rifle may differ as to name, be it the Krag-Jorgenson, Lee-Medford, Mannlicher, Mauser, Mouzin, or Arisaka, yet the wounds produced are the same.

Russia has armed her land forces with a rifle designed by Colonel Mossine (or Mouzin) which is similar to the Mauser. It has four grooves and gives an initial velocity of 2075 feet. The magazine box is vertical under a receiver attached to the trigger guard, has no cut off, and holds five cartridges, which are introduced from a clip. The bullets are of hardened lead with cupro-steel envelopes and weigh 310 grains. The caliber is .275 inch; range, 2096 yards; pitch of trajectory at 1970 feet is seventy-two feet. Smokeless powder is used. The naval forces are armed with this same rifle of 1891 design and also with the Lee straight-pull, caliber .236 inch, which is the smallest caliber in use in any army.

Japan has part of her army supplied with the Murata rifle, which is constructed on the unwieldy fixed magazine tube sys-

tem, and has a range of 2187 yards. This rifle has a tubular magazine under the barrel, holds eight cartridges, and is charged through a receiver, a single cartridge at a time. It weighs over eleven pounds when loaded and has a caliber of .315 inch. The majority of the Japanese troops are equipped with the rifle designed by Colonel Arisaka, type of 1897, which is made in Japan, and is almost identical with a Mauser rifle, though a little superior to it. It has a .25-inch caliber, with six grooves, an initial velocity of 2378 feet, and pitch of trajectory at 500 yards of only 3.87 feet. It holds five cartridges in the magazine, which are introduced on a clip. The range is 2500 metres. The bullet is of hardened lead with a German-silver jacket and weighs 158 grains. Smokeless powder is used.

In comparing the rifles of the two armies, it is easily seen that Japan has a smaller bullet with greater penetration, flatter trajectory, and greater range. Yet the difference is very little if the wounds produced are compared, as all high-velocity small-caliber bullets give practically the same wounds, according to my experience with Mauser and Krag wounds in Cuba, the Philippines, and China.

The chief interest to the surgeon in war wounds centres about the high-velocity bullet, and its effect on the human system. The wounds produced by it can be better understood if the chief points of difference between the new and old rifles are remembered. 1st, The increased velocity; 2d, decreased caliber; 3d, shape and weight of the bullet; 4th, construction of it; 5th, addition of a magazine; 6th, the use of smokeless powder. These changes have produced increased rapidity of fire, increased range, a flat trajectory, and thereby an increased danger zone. The increased velocity has no practical bearing on wounds in the soft tissues, and its most obvious ill effects are seen in the different parts of the nervous system, according to Makin's experiences in the South African War, but a notable exception must be made in the case of brain wounds, for in many cases of men shot in the head, and found dead on the field, I have seen the entire brain tissue pulpified. The skull bones, however, were the cause of this, as the greater effect of

the high-velocity bullet was seen in the high resistant structures,—the bones and their contiguous soft parts.; the velocity being imparted to the bones, and by them to their surroundings. The decreased caliber makes a smaller wound, and a smaller area means less resistance on the part of the tissues, and thereby less stunning effect. The shape of the bullet offers less resistance, and thus gives greater penetration, too. The hard mantle used in its construction renders alteration either without or within the body more difficult, making lacerating wounds rare, and restraining the bullet from leaving in the tissues detached fragments. The addition of a magazine, smokeless powder, the increased rapidity of fire, and lengthened range, all tend to decrease the number of sword and bayonet wounds, as the engaging sides can rarely get close enough for their use. The trajectory or curved flight of the bullet is flatter than in the old style. The high-velocity bullet when fired from the rifle at the shoulder, which rifle has been sighted to 500 yards, can cover some part of the standing man the whole extent of its flight. This vastly increases the danger zone, and therefore increases the number of the wounded.

In dealing with the general character and nature of wounds caused by this high-velocity projectile, two classes are easily apparent. (1) Those injuries from the direct effect of the bullet on the tissues in which it comes in contact. (2) Those injuries resulting from indirect or remote effect by the transmission of the force of the bullet laterally to surrounding tissues and organs. This latter class, if the hydrodynamic theory is correct, is caused by the bullet displacing the fluid in the tissue cells, and transmitting a wave effect through the neighboring parts. Stephenson, in his "Wounds in War," has an excellent defence of this theory, illustrating it by the effect of a high-velocity bullet on a closed leaden can filled with water, which badly shatters the can by the effect of the waves of water generated thereby. The tissues and covering of the brain are analogous to this closed can and its contents, and the effect is generally the same.

Reverting to the first class—the direct effect on the tissues.

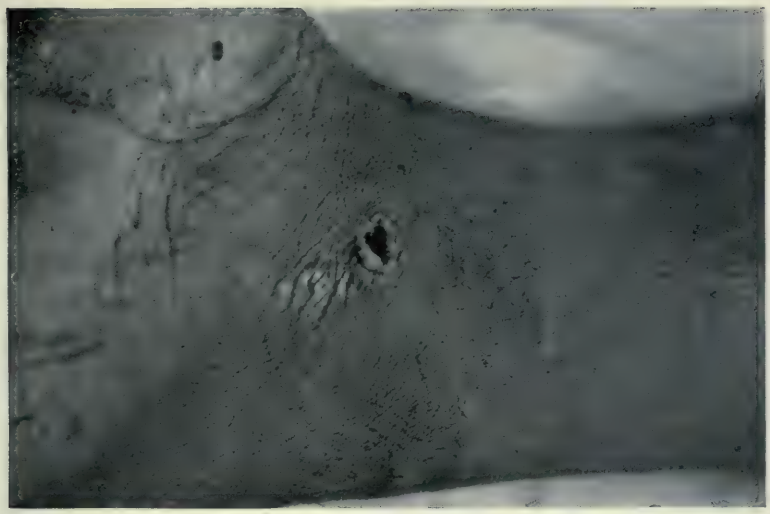


FIG. 1.—Case I. Entrance wound, Mauser bullet, undeformed, distance less than fifty yards. Left ankle.

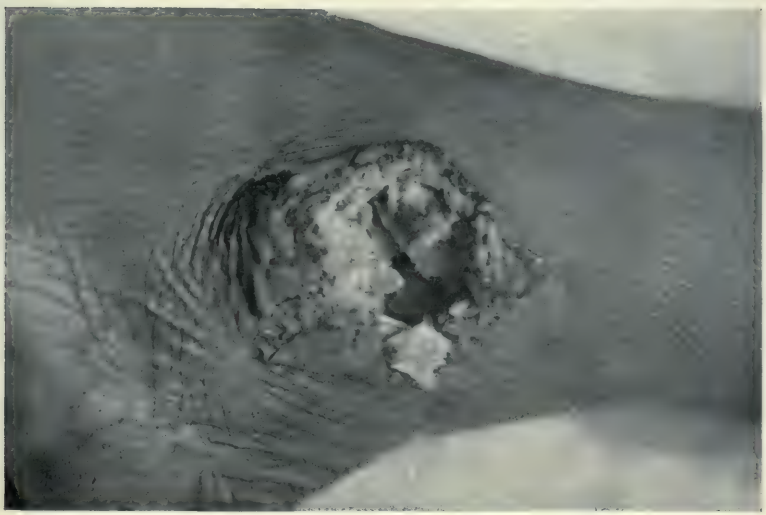


FIG. 2.—Case I. Exit wound, Mauser bullet, undeformed, distance less than fifty yards. Left ankle. Shows explosive effect at short range.



FIG. 3.—Case III. Stellate entrance wound, Krag bullet, undeformed, distance less than fifty yards. Right ankle.



FIG. 4.—Case IV. Entrance wound, Krag bullet, undeformed, right knee, distance less than fifty yards.



FIG. 5.—Case IV. Exit wound, Krag bullet, undeformed, near popliteal space right knee, distance less than fifty yards.



FIG. 6.—Case II. Entrance wound, Mauser bullet, undeformed, distance less than fifty yards. Over left tibia. Notice splitting of skin, not caused by bullet, but by fragments of bone flying upward, and, as but little flesh being between skin and tibia, the skin is split by them. Illustrated by ends of a board flying up when board is broken in the middle. Notice X-ray picture of this.

the entrance wound is often described as having a punched-in look. It is more a punctured or perforating injury than those seen in the Civil War. When the bullet impinges at right angles to the body the entrance is circular, and slightly less in diameter than the projectile. The edges for a small fraction of an inch are discolored, and the skin has a contused look. However, when the wound has been received at a very short distance, or at the extreme range, the entrance wound I often found to be larger than the diameter of the bullet. In Case No. 6 of the sixty-nine killed and wounded in the attack on Laoag, Luzon, April 17, 1900, the entrance aperture was nearly an inch in diameter in the right axilla. It was received at a distance of less than fifty yards. The wound was circular, made by a Krag bullet, and was undoubtedly the wound of entrance, as in its exit the bullet blew off the top of the skull. This has been explained to me by ordnance officers in the army, that the bullet in its first few yards of flight has not yet steadied itself, and its axis of rotation has not become parallel to the line of its trajectory, as only the last half of the bullet is caught up by the rifling of the gun-barrel. This may be the true explanation. At extreme range the wound of entrance is also larger than the diameter of the bullet. Ordnance officers also give the causes for this in the tendency to wabble when the bullet has lost almost all its velocity and rotation. An example of that is the case of a private of the Thirty-third United States Infantry at Tagnadin Pass, whose wound of entrance was over three-fourths of an inch in diameter and circular. It was received at a distance of over 2000 yards, and must have been near the extreme range of the bullet, as it lodged in the brain substance. Nancrede gives the true explanation of the lodgement and deflection of the majority of modern small-arm projectiles as due to the laws of physics and ballistics, and not due to ricochet; the hypothesis being that from 1000 yards to 1500 yards the bullet tends to revolve on its short axis and is thereby easily deflected. (See Figs. 1, 2, 3, 4, 5, and 6.)

Wounds of entrance are atypical, also when received at an angle or from ricochet. Out of sixty-nine dead and wounded

at the battle of Laoag, thirty had atypical wounds of entrance. As the fighting was at short distance, few of these were ricochet wounds, and the bullet had entered at an angle, sometimes scoring the skin for several inches before penetrating it. Ricochet wounds are contused and lacerated, as well as multiple, as a rule, and in many instances stones, gravel, and dirt are carried in by the bullet or its fragments. For four months in the spring of 1900, I occupied my leisure moments in extracting gravel and bullet fragments from the multiple wounds in the hips of a teamster wounded by ricochet, by the accidental discharge of a Krag at a distance of ten feet, the man having been standing in a gravel road. It is needless to add that suppuration is to be expected in such cases.

Exit apertures vary widely. The skin being unsupported on the exterior accounts partially for the exit being larger than the entrance. At normal velocity the exit aperture often resembles the entrance so closely as to be difficult of differentiation. At low velocity, it may be a mere slit, so small as to defy discovery.

Senn, in his Lane lectures in San Francisco, July, 1899, told of a case in which he had opened the knee-joint for a retained bullet, as he could find no exit. As nothing could be found in the joint, diligent search over the popliteal space revealed a slit in the skin but one-half inch long, which he had overlooked, much to his disgust. A proper use of the Röntgen ray obviates such needless operations. When the bullet emerges through the skin very obliquely, a long ditch-like wound results, much wider than one would suppose, and very intractable in healing. Unlike the slit exit, the skin retracts, leaving a gaping wound. At the engagement at Vigan, Luzon, December 5, 1899, an insurgent soldier, lying down behind the stone fence at the hospital, raised his head to look out. A Krag bullet struck him on the top of his head, raised a thin plate of bone, with adherent scalp, and passed out near the occipital prominence. The wounds of entrance and exit were long ovals, and a gutter fracture of the skull resulted without brain lesion. Not only were the wounds months in healing, but the

intervening bridge of scalp sloughed off, and I removed a thin plate of bone covering about one square inch before resolution would take place. The horrible wounds of exit, due to the supposed explosive bullets, or to lesions of bone forcing the internal tissues through the skin, will be spoken of under the effect on bones.

The track of a normal bullet through the body is straight. The high-velocity bullet does not run along the ribs, and play hide and seek in the body as the old has done. A private of the First Nebraska Regiment, wounded in the Philippines, came under my care in June, 1899. He had two oval scars, the first at right angles to the axis of the body, near the left anterior superior spinous process; the other parallel to the axis of the body just below the umbilicus. He informed me that the surgeon had told him that the ball had been deflected at almost a right angle from the pubic bone, and for several weeks he had discoloration of the skin over this angling track. My own experiences lead me to believe that such a course for a high-velocity bullet is impossible. Through muscular tissue this bullet slits and tears, perforates cancellous bone, splinters and comminutes dense bone, and bites out pieces of nerves and blood-vessels. A hard, fibrous cord marks its track after healing.

Localizing the bullet wounds, and at the same time noting the indirect effect of a bullet on the tissues concerned, injuries of the head may well be dealt with first. The surgeons of the Portland Field Hospital in the South African War remarked that "wounds of the head still continue to be the most fatal of all the injuries received on the battle-field." Of the 305 United States soldiers killed in action in China and the Philippines for the year ending June 30, 1901, seventy-eight had fracture of the skull. This number of fatalities was only exceeded by penetrating wounds of the thorax, which caused 101 deaths. In the Civil War, 57 per cent. of all gunshot fractures of the head were fatal. In the Spanish-American War, as near as I can learn, 64 per cent. were fatal. According to the Surgeon-General's report for the year ending June 30, 1901, 94 per cent. of all

gunshot fractures of the head received in action died. This would seem to imply that, notwithstanding antiseptic treatment, the modern bullet is not as humane in skull injuries as the old. The reason of this is the explosive action on bone and on cavities filled with fluids or semifluids. This action is noted in distances less than 500 yards approximately. Forwood speaks of the fact that after 1600 metres clean perforations of the skull occur. Freer cites the case of a Mauser bullet at 1000 yards penetrating the centre of the forehead and emerging at the right temple. Entrance and exit wounds were clean-drilled holes. The patient was convalescent in three months. At extreme range the bullet is humane. At the general hospital in Old Point Comfort, July, 1899, I examined a negro soldier who, at the battle of Santiago, had been shot by a Mauser bullet at over 1500 yards, which penetrated his skull from occiput to the ramus of the jaw. Some paralysis at first was present, which at the time I saw him had entirely disappeared. It seems improbable that the same kind of bullets could cause the following injuries, which were taken from my case-book, occurring at the battle of Laoag, Luzon, P. I., April 17, 1900.

Case No. 6.—Native Filipino, found dead shortly after the fight; distance shot less than fifty yards. Entrance wound about one inch in diameter in right axilla. Exit, whole rear of the head blown out, cranial contents gone from parietal to parietal, all gone clear down to the base of the skull.

Case No. 7.—Native Filipino, dead. Distance, probably less than 100 yards. Entrance wound three-fourths of an inch by three-fourths of an inch centre right ear. Exit, the entire left side of head including ear gone, with fracture and displacement of all the rest of the bones of the skull, as well as malar and superior maxillary of left side of face.

I have records of other cases almost as severe as these two cited. These were all produced by Krag bullets undeformed, and not filed at the apex to render them explosive. The terrible injuries to the skull lead many to believe that the bullets had been tampered with, but, as close inspection was made of our

ammunition before the fight, it must have resulted from the velocity of the bullet alone. "Gutter" fractures, or those resulting when the bullet chips up a portion of the bone, leaving a neat "gutter" behind, are rare, and also rarely fatal, as in the case cited. The gunshot fractures in the Boer War have generally been received at long range, and consequently do not show the explosive effects as seen in the Philippines, where such wounds were usually at short range, due to ambuscades.

Von Bergmann tersely sums up the head injuries as follows: At fifty metres the scalp is preserved and continues to hold the skull together, though the latter is broken into many fragments. At 100 metres the destruction of the skull is somewhat less, though two zones of comminution can be grouped around the wounds of entrance and exit. At increasing range the damage decreases. At 1800 metres and upward we have clean-cut bullet-holes. At 2700 metres the bullet remains embedded in the brain.

Wounds of the face gave little trouble unless some important nerve was cut, as the bone and cavity conditions were absent. However, when the inferior maxillary bone was involved, much annoyance was often caused by the non-union of the fragments, as in the case of Captain Gibson of my own regiment, where excessive destruction of this bone left him with a useless lower jaw. Retained bullets in the face were sometimes found.

Borden reports a case of a private in the First Nebraska Regiment with retained bullet in right antrum of Highmore; localization by X-ray and recovery. This case came under my observation at the United States General Hospital, San Francisco, June, 1899. Ankylosis of the jaw and retinitis with atrophy of right eye were present. An unsuccessful attempt, after two radiographs had been made, to remove the bullet was followed by its complete removal August 16, 1899, by Major A. C. Gerard, Surgeon, United States Army. Bullet was found to be a deformed Remington. The last time I saw the case was September 7, 1899, when almost complete recovery had taken place. The patient, however, at that time was suffering far more from an

X-ray burn six inches in diameter than he had from the presence of the bullet. Borden also reports a case of lodged bullet in the brain with recovery. From conversation with many army surgeons, I am led to believe that recoveries are exceedingly rare in such cases. In the one case I had, a private in the Thirty-third Infantry, at the battle of Tagnadin Pass, December 4, 1899, death took place within twenty-four hours. The distance was nearly 2000 yards; entrance over fissure of Rolando, left side, bullet presumably had passed towards the base of brain, and was not found. Patient unconscious from the receipt of injury with total paralysis of right side. The bullet had penetrated so deeply and the condition of the patient such that it was not followed to its lodgement.

Wounds of the neck were of the gravest importance on account of the large blood-vessels and nerves there. Some of the narrowest escapes occurred in this region. This class will be noticed under wounds to blood-vessels and nerves.

Wounds of the chest have not been given sufficient prominence by the writers on high-velocity projectiles, I believe, and my statement is based on the Surgeon-General's report for the year ending June 30, 1901, that the largest number of deaths in action—101—were due to wounds in the chest. So many marvellous recoveries have been recorded that one is apt to forget that such injured usually die on the field of action. If they live long enough to reach a hospital, the great majority, nearly 80 per cent., recover. The percentage of mortality in the Civil War, of penetrating wounds of the chest, was 65 per cent. I am unable to get accurate figures for the Spanish-American or Boer Wars, though Greenleaf, in the former, reports twenty-four cases, with nine deaths, or 37 per cent. fatal. These do not, I believe, include any found dead on the field from chest wounds. In 1901, in the Philippines, of all penetrating wounds of the chest in action, 74 per cent. were fatal. The wounds may be divided into two classes. (1) Those of bronchi and lungs. (2) Those of heart and blood-vessels. The first are numerous, and rarely fatal unless the root of the lung is involved, in which case most of the patients succumbed on the field; or in those

cases where the bullet was lodged in the lung tissue. Repeatedly have I seen men shot anteroposteriorly, and have little hæmoptysis and slight hæmothorax, the wound closing up beautifully, with no infection or untoward symptoms. The celebrated case reported by the surgeons of the Portland Field Hospital in the Boer War shows what a slight shock these bullets make: "A man, whilst firing in the prone position, felt his pipe break in his breeches pocket, and presently put his hand down to feel what had happened. He withdrew his broken pipe, and also a bullet, and then finding some blood on his hand, thought he must have been wounded. As it turned out, he had been hit by a bullet, which entered the shoulder and traversed the lung and abdomen, and yet had caused him no pain or sense of injury."

Lodged bullets give rise to much pain and often severe hæmorrhage. A soldier under my care, in the United States General Hospital at San Francisco, had one lodged in the upper lobe of his right lung, according to the radiograph. At recurring intervals, about ten days apart, he would be seized with a violent pain, and a severe hæmorrhage through the mouth would ensue. He grew weaker and weaker and probably died, though I was unable to follow the case through on account of orders for foreign service. Pain in breathing was also noticed in those cases where ribs were fractured.

Wounds of the heart and large blood-vessels of the chest were seen in autopsies only. I have seen one man with a wound one inch above the left nipple, and also saw one in a similar place below the left nipple, and no symptoms of involvement of the heart. Recoveries uneventful in both cases.

Wounds of the spine were similar to those seen in our civilian hospitals, and little could be done for them. The inevitable resulting paralysis and decubitus rendering the patient a burden to himself and all concerned. The bony column surrounding the cord gave a high-velocity bullet awful opportunity for explosive effect. Sixty-two per cent. in the Spanish-American War were fatal, which is 7 per cent. more than in the Civil War.

Wounds of the abdomen have caused much discussion and many differences of opinion. They still remain of the gravest character, and are far more fatal than the hospital records show. Ninety-one per cent. of those soldiers with penetrating abdominal bullet wounds in the year 1901 in our army were fatal. Of those who survived long enough to be carried to a hospital, 80 per cent. of these were fatal. At the battle of Laoag, Luzon, thirty-three of its sixty-nine killed and wounded had penetrating abdominal wounds. Twenty-six of these died before I could see them. The remaining seven died within seventy-two hours. It is exceedingly exasperating to see these cases passing away, no matter whether conservative or operative treatment is used. Of the organs wounded, the spleen produced death quicker than any other, which was undoubtedly due to hæmorrhage. The liver would allow perforation, providing the large blood-vessels were not touched. The only case of recovery in my own practice from penetrating wounds of the abdomen was of this class:

A Filipino woman was walking along the streets of Laoag, Luzon, in October, 1900. A native scout, twelve feet away from her, in cleaning his Krag carbine accidentally discharged it. The bullet entered the woman's abdomen, right side, immediately beneath the eighth rib, at the edge of the rectus abdominalis, and passing backward and to the right emerged in the same transverse plane two inches posterior to the axillary line. For a week her temperature was over 102° F., at the end of which time it gradually fell to normal, with uneventful recovery. The entrance and exit wounds were small and quickly healed. No surgical interference was used.

Wounds of the stomach were not so fatal as those of the intestines, though in my own experience I have never seen a recovery. Senn's theory that wounds above the umbilicus were favorable for recovery was not always upheld by the surgeons who examined the dead on the battle-field. When the small intestines were perforated, death invariably resulted. Makin

reports in the South African War that all the cases in which perforation was diagnosed in the hospital resulted fatally, and that undoubtedly, of the cases that recovered spontaneously, the injury was not of a perforating nature. Watson Cheyne, in *British Medical Journal*, May 12, 1900, reports, from his own experience with wounds of the abdomen, "that the results were not nearly so good as he had been led to believe." The surgeons of the Portland Field Hospital also report that "far too favorable an opinion has been formed of the results of such injuries." On the other hand, in the Spanish-American War there were forty-four penetrating wounds of the abdomen with thirty recoveries. Ojuna reports that 70 per cent. of the Spanish soldiers wounded in the chest and abdomen in the battle of Santiago recovered. He evidently includes non-penetrating wounds in his statement, which materially lessens its value. Robinson reports twenty recoveries out of forty-five cases received at the First Reserve Hospital, Manila. This latter report is misleading, as it does not state out of how many hundreds of cases of abdominal injuries were these forty-five culled. Many of these were undoubtedly on the road to recovery before being shipped to Manila, as the First Reserve Hospital was miles, and sometimes hundreds of miles, from where the wound was received. As Bowlby, the English surgeon, in commenting on Robinson's statement, says, "From what we have been able to learn, we are of the opinion that a considerable number of men shot through the abdomen die very quickly, or within a few hours; and we think that the patients who were seen at the Base Hospitals" (as was the First Reserve) "were to be regarded as men who had either escaped injury of the bowels and bleeding into the peritoneum, or in whom the perforation of the intestines had not been followed by its usual complications. They represented the few survivors of a large number of men who had died from wounds of the abdomen, implicating the small intestines, and were not to be regarded as *in any way* illustrative of the usual results of such injuries." Transverse and oblique wounds of the intestines were always fatal.

Wounds of the large intestine were not as fatal as those of the small. The denser muscular coat assisted in closure of the opening. Also the conditions in the large intestines seemed better for a localized peritonitis and circumscribed abscess similar to those of appendiceal origin. Therefore wounds in the lumbar region were not considered so serious as those nearer the centre of the abdomen.

Wounds of the kidney caused little trouble, and with fatalities about the same as wounds through the extremities. Through the bladder trouble was experienced from extravasation of urine. These injuries were not considered very fatal.

Recapitulating, we find the consensus of English and American surgeons placing abdominal wounds as regarding fatality in the following order: (1) Spleen wounds most fatal of all. (2) Perforating wounds of the small intestine and mesentery. These were more liable in the transverse and oblique passages of the bullet through abdomen. (3) Wounds of the stomach. (4) Wounds of the large intestine. (5) Wounds of bladder. (6) Wounds of liver. (7) Wounds of kidney. (8) Non-perforating wounds of the intestine; the least fatal of all. As a general rule, from the statistics I have examined, I would suggest that, excepting splenic wounds, the mortality of penetrating, anteroposterior abdominal wounds is in inverse ratio to distance from centre of abdomen. In other words, the farther from the centre the greater chance of recovery.

Wounds of bone (Figs. 7, 8, 9, 10), especially those of the long bones, are important from the explosive effect which is here seen. The bones of the skull enclosing the brain give the worst effects. McCormac, in the *Lancet*, August 3, 1895, says, " Explosive effect is due to rapid arrest of the flight of the bullet on piercing fluid matter, and its motion being transferred to parts immediately surrounding, and these again to parts further removed, somewhat as wave circles by throwing a stone into water." This view has been modified since 1895. Schachner, in ANNALS OF SURGERY, January, 1900, says, " Explosive



FIG. 7.—Case II. Mauser bullet, undeformed, middle of lower leg, entrance directly over tibia, showing comminution of the same.

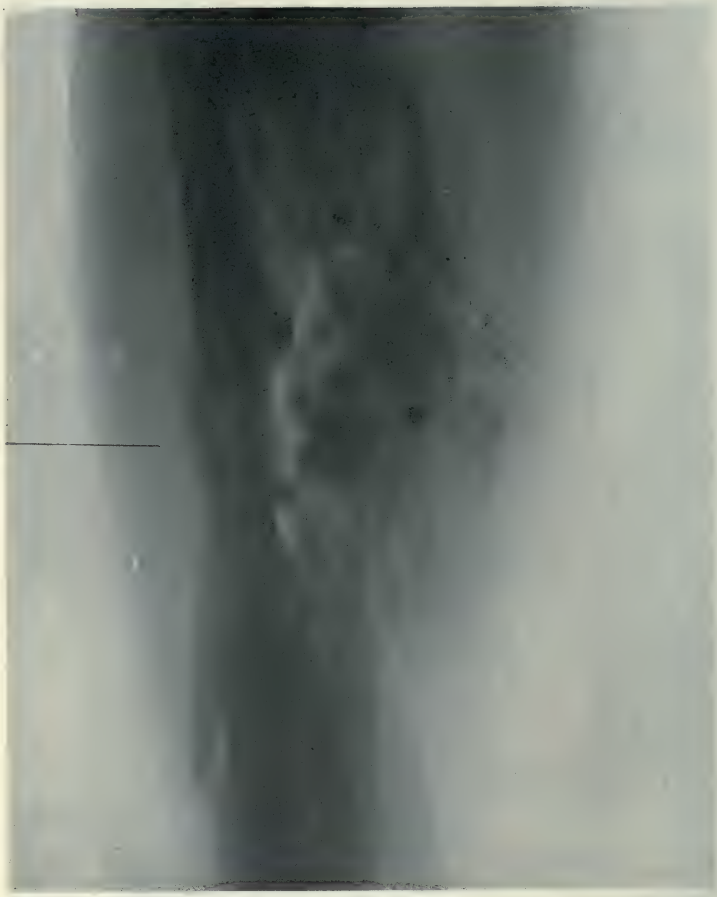


FIG. 8.—Case II. Mauser bullet, undeformed, middle of lower leg, entrance directly over tibia, showing comminution of the same.

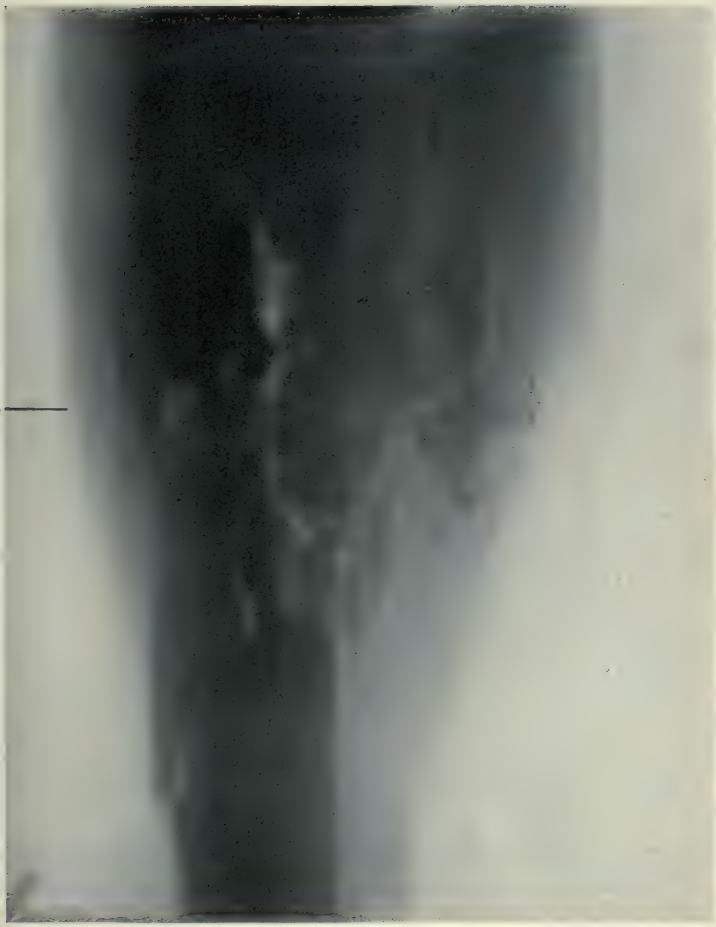


FIG. 9.—Case II. Mauser bullet, undeformed, middle of lower leg, entrance directly over tibia, showing comminution of the same.



FIG. 10.—Case I.—Mauser bullet undeformed through the malleoli at distance of less than fifty yards.

action is due to the deformation of bullet, range, and character of tissue." He places the range at anything less than 1000 yards. My own experience leads me to believe that the explosive action is due to short range, a hard bone, and soft tissues on the distal side of the bone. The cases of skull injury cited before uphold this theory.

Another case also, Juan Aguinaldo, sergeant of insurgents, shot by Krag carbine, July 7, 1900, at Pasuchin, Luzon. Distance 125 yards. Entrance wound, one-half inch by one-half inch, typical, three inches below internal condyle right femur, course downward and outward, fracturing both tibia and fibula, comminuting the former, so that not a piece three inches long remained. Exit, the whole external surface of the leg, blowing out much of the muscular tissue, and what remained was filled with spicules of bone. The comminution of bone was so extensive, amputation was advised, which I did under spinal anæsthesia, July 8, 1900, the first use of subarachnoid anæsthesia in the Philippines.

Robinson saw twenty-four cases of explosive effect out of 462 cases of bone wounds; all were in long bones or calvarium, and not at extreme range. Von Bergmann, in speaking of wounds of the extremities, remarks that "the wound of exit is usually small, even at close range." This theory is at variance with the experience of American surgeons, who often found a large wound of exit at short range especially. Explosive action can also be due to the filing of the hard apex until the soft core of the bullet is reached. This is then called a "soft-nosed bullet," and "mushrooms" upon striking the harder tissues.

Forwood believes that bullet wounds in bone beyond 600 yards give clean perforations without splintering, especially in spongy bone; while Senn remarks that extensive comminution of bone exists when the distance is within 500 yards; perforation and no splitting in the next 500 yards, and beyond that comminution. English authors do not agree with him, but affirm that the comminuting effect diminishes as the veloc-

ity decreases, and that perforations occur in cancellous bone at any distance, but rarely in the shaft of the long bones. After seeing several hundred cases of bone injuries, I have yet to see a perforation alone except in cancellous bone. In comparison with Civil War wounds we had less transverse fracturing, more longitudinal splintering, the explosive effect in exit wound, the striking contrast of extreme comminution of dense bone, and simple perforation of cancellous, and, finally, the ease with which these wounds healed without amputation. In the Civil War the injuries to extremities showed a fatality of 19 per cent.; in the Spanish-American War but 1.8 per cent.; a decided gain due to high-velocity bullet, aseptic and conservative surgery.

Wounds of the joints made by the small caliber bullet were not much more serious than uncomplicated wounds of soft parts, the cancellous tissue of the joint allowing perforation instead of comminution. Nancrede states there were 161 gunshot wounds of the large joints in the Spanish-American War; seven amputations and one resection made, and only ten deaths out of the entire number wounded. This gives a mortality of 6 per cent. of all cases operated on or not, which is quite different from the records of the Civil War, which of the knee-joint alone treated conservatively shows a mortality of 60 per cent., which percentage would be increased if those operated upon were added. Frederick Smith, however, thinks that, while injuries to the knee-joint have been benefited by the small-caliber bullet, the injuries to the ankle- and wrist-joints are about as bad as with the old bullet. Yet the fact remains that joint injuries are not the serious lesions they were with the old-style bullet.

Blood-vessels have shown a marvellous capacity to escape injury. Makin thinks that this may be due to an effect similar to that seen in a limited train which has been known to throw articles off the track without touching them,—the air in front of it acting as a buffer. Hæmorrhage from the perforated vessels has not been as severe as expected.

I saw one case of the external carotid perforated in an officer; the common carotid was ligated, recovery followed. Another case was that of a native. The external carotid artery and internal jugular vein were both perforated. Ligation in this case did not save him, as several hours had elapsed before I saw the case, and too much hæmorrhage had ensued. The best example, though, is the case of private Saiter, Twelfth Infantry, from Evansville, Indiana. This man was shot from ambush, and, being deserted by his comrades, crawled into the bushes several hundred yards away, and lay there sometime before being found. When brought into the hospital, I found a typical entrance wound, middle external surface, right thigh. Exit, typical at posterior edge, inner condyle of right femur. Diagnosis, perforation of femoral artery in Hunter's canal. Every effort was made to establish collateral circulation without success, and after a week the leg presented that classical color and condition seen when both afferent and efferent blood-vessels are occluded. I amputated at the lower third of the thigh, and found that both vein and artery had been entirely cut through, clots being found in both. It was peculiar to me that fatal hæmorrhage had not occurred at the time of injury, or during the subsequent movements in crawling. Recovery occurred, and patient sent to Evansville.

Aneurisms frequently occurred with the usual involvement of contiguous vessels and structures. The one case I had will be reported under nerve injuries.

Injuries to the nerves occurred with great frequency, both in our own wars and also in the South African campaign. As most of them were concussion and contusion, the resulting paralysis, as a rule, gradually diminished, and in most cases vanished completely. Senn reports one of the cases under my care in his " Practical Surgery."

A hospital corps man was shot at Malabon, Luzon. Entrance wound just below the level of the right shoulder-joint on axillary side of the scapula. Exit, anteriorly, base of axilla and inner border pectoralis major muscle. Paralysis complete from the start. An egg-shaped swelling soon appeared in axilla. Diagnosis, aneurism axillary artery, third portion. When under my

care in June and July, 1899, at the Presidio, San Francisco, the aneurism was compressible, and I recommended ligation. The patient was prepared for operation, but Dr. Senn decided to wait, hoping to have the functions of the nerves involved restored in time without surgical interference. When I last heard of the case in September, 1899, the functions of the median nerve had been re-established, but not those of the ulnar.

The treatment of the bullet wounds has been carefully avoided in this paper, for, as a general rule, they should be treated exactly as those we have in our civil hospitals here at home. However, my own experience, supplemented by the experience of other army surgeons, caused me to always cut down on a large-sized low-velocity bullet, as the Remington, if possible, and lay its track wide open on account of the attendant infection. Also, to leave a small-sized high-velocity bullet alone, hoping it may become encysted. Scores of such bullets are being carried about to-day without any trouble. One of my cases, which Dr. Senn has also reported, has a bullet lying close against the rectum one and a half inches above the sphincter. A radiograph found it there, though the point of entrance was just above the popliteal space. It causes him no trouble at all. Borden reports a case of a soldier who still carries a bullet in the brain without irritation of any kind. Another observation is the enormous recuperative power of bone tissue after gunshot injuries. Very rarely is amputation justifiable. Formerly, it was thought best to amputate in wounds of the joints, but under antiseptic treatment it is rarely, if ever, needed.

The treatment of bullet wounds of the abdomen in war has not been satisfactory from a surgical stand-point. Every one operated on in the Spanish-American War died. Nearly all operated on in the Boer War were fatal. It is impossible to do the patient justice on the battle-field; and while such operations should be performed in civil hospitals where conditions are favorable, so far we have not been able to conduct such operations with success on the field of action, and by the

time the patient is transported to the Base Hospital he has passed the operating time. Conservative treatment alone has given the best results, according to the majority of army surgeons. Gibson insists on the expectant treatment because those who had penetrating wounds of the chest or the abdomen and got well were treated that way. Flagg mentions the fact that for the three years ending June 30, 1901, of the sixteen laparotomies for perforating gunshot wounds of the abdomen in the army, thirteen died. Makin, in his South African experience, notes that, of six bullet perforations of abdomen operated on from three to four days after being wounded, only one recovered; that it was better to operate inside of twelve hours or not at all; that it is better to operate before transportation than afterwards. In nine cases diagnosed as perforations of abdomen and not operated on four recovered, giving a mortality of 83⅓ per cent. for those operated on, and 55⅝ per cent. for those treated expectantly without operation. Nancrede is "opposed to operating in the field except under circumstances too exceptional to be noted." Senn straddles the question by stating that there should be "immediate operative treatment of gunshot wounds of the abdomen where hæmorrhage or fatal lesions dictate such a course." Forwood decides on immediate operation or not at all, as wounds of the viscera do not admit of delay. Borden gives forty-four as the total number of penetrating wounds in Spanish-American war, of which number four were operated on, with a mortality of 100 per cent. Of the forty unoperated on there was a mortality of 62½ per cent., and he summarizes "Laparotomy should only be used in those cases in which the surgeon is sure death will occur without it." In the three cases operated on by Banister two died, while the one with a revolver wound recovered. Hildebrand explains some of the mortality in the South African War in that "Not a single case of penetrating wound of the abdomen was operated on in less than three days." Probably such statements as that encourage surgeons like Harris, who believes in drainage and operation in all cases of penetrating wounds of the abdomen. La Garde trusts in the simple aseptic dressing as the best.

Treves has formulated the following rules, which are the clearest and most concise that I have found. In penetrating abdominal bullet wounds he advises operation if (1) Patient is seen before seven hours have elapsed. (2) Patient has had an empty stomach when wounded. (3) Patient has had a short and easy transport. He advises non-interference if (1) Patient not seen until seven hours have elapsed. (2) There has been a long and tedious transport. (3) Patient has been wounded soon after a meal. (4) The liver, spleen, or kidney be wounded. (5) It be a transverse or oblique wound above the umbilicus. (6) The bullet is retained. (7) The wound be below umbilicus, as in this locality the patients generally get along all right. (8) The colon alone be implicated (except the transverse). "It comes to this, that the cases that are suited for abdominal section on the field are, roughly, exceedingly few." Poey hits the nail on the head when he says "Less surgical interference, the better the results ultimately; common sense and antiseptic treatment will do more than all the surgical operations possible."

No less an authority than MacCormac says, "The treatment of the larger portion of Mauser wounds is generally of the expectant kind, and this is especially true of abdominal wounds. But in every region of the body, the percentage of cases terminating fatally is diminished."

That the modern rifle is more humane than the old can no longer be doubted. In the Civil War there was one man killed to every 4.5 wounded; in the Spanish-American and Philippine Wars there was one man killed to every 7.4 wounded. The Civil War has a mortality of the wounded of 13 per cent. The Spanish-American cut this percentage in two, and the records of the hospitals in the Philippines reduced this nearly one-half. In the North China campaign there was a mortality of the wounded in the Japanese army of 3.2 per cent. It is to be hoped that when the accurate statistics of the Russian-Japanese War are published that even this small percentage will be diminished.

From my own experience in Cuba, the Philippines, and China, and from the published records of surgeons who have

participated in active campaigns, the modern bullet is humane. And it seems to me that the treatment should be humane, too, which should seldom be operative, but usually an aseptic conservatism.

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SOME EXPERIMENTS WITH A NEW METHOD OF CLOSING WOUNDS OF THE LARGER ARTERIES.[1]

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THE object of this communication is to report and place on record some experiments undertaken with a view of obtaining some new and simple method of closing accidental wounds of the larger arteries.

The desirability of such a method was forcibly presented to the writer some years ago by an experience which occurred while performing a Bassini operation for the radical cure of inguinal hernia.

The patient was a young man about twenty-eight years of age, who presented himself for treatment of a left inguinal hernia complicated by an undescended testicle. Operation was advised, and the suggestion was readily accepted by the patient.

After removal of the sac of the hernia and the atrophied testicle, while introducing one of the deep sutures of chromicized catgut, a sudden gush of blood occurred from the deeper portion of the wound, which flooded the region and gave rise to a rapidly developing hæmatoma in the surrounding tissues.

It was evident that some deep vessel had been wounded, and an attempt was at once made to locate the injury. Digital pressure on the track of the suture temporarily arrested the bleeding, and the areolar tissue covering the iliac vessels was soon removed, exposing the external iliac artery for about one inch above Poupart's ligament. By transferring the pressure to the proximal portion of the exposed artery, it was seen that the sharp cutting point of the large Hagedorn needle had penetrated the wall of

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the vessel, making a clean-cut, longitudinal wound about one-quarter of an inch in length. As soon as the proximal pressure was removed, a column of blood issued from the wound with such force that it rose fully two feet in the air, a fact which indicated an unusual degree of blood-pressure.

The grave risk of gangrene, amputation, and death, which would necessarily accompany ligation of the external iliac under these circumstances, clearly indicated the advisability of arterial suture and restoration of the blood supply to the limb. As the patient's condition was in every way satisfactory, this was deliberately undertaken with every hope of success.

The wound in the vessel was freely exposed, proximal pressure being maintained, and two or three sutures of fine silk were carefully introduced by means of a small, round, curved needle. These sutures included all the coats of the vessel but the intima, and when drawn together and knotted brought about a satisfactory approximation of the edges of the wound. The proximal pressure was then cautiously removed and the arterial current gradually re-established. At first it seemed that the closure had been successful, but as soon as the full force of the blood-pressure was restored, the stitches began to cut through, and in a few moments the entire wound was reopened by the force of the systolic impulse.

Proximal pressure was again applied and a second attempt made after removing the old sutures. This time the sutures included more of the vessel wall, and the line of approximation was further reinforced by uniting a mass of areolar tissue over it; but the result was the same, the arterial tension was so high that it would have torn out any suture that could have been used, unless the vessel could, at the same time, have been supported by being surrounded with some elastic material which would temporarily diminish its full expansion and the consequent traction on the sutures.

As the arterial wall was by this time so frayed by the torn-out sutures that no further attempt at closure could be undertaken, nothing remained but ligation, which was accordingly performed, and the hernial wound closed in the usual manner.

By rare good fortune, no untoward results followed the ligation. There was scarcely any difference in the temperature of the two limbs, the patient experienced no discomfort, and was

discharged from the hospital, at the end of four weeks, completely cured.

It was during the performance of this operation that the idea of an elastic arterial plaster occurred to the writer.

It was evident that the failure of the sutures to hold was due to the high intra-arterial pressure and the force of the systolic impulse, both of which tended to the separation of the approximated edges.

It seemed at the time that if the vessel could be surrounded by some material which would limit the amount of expansion for even a few hours, and maintain approximation of the edges of the wound, adhesion would occur even without sutures. If so, such a method would also be applicable to many conditions in which suture would be impossible, as in an exceedingly thin or diseased arterial wall, calcification of the media, etc.

The material for such a plaster should be thin, elastic, and capable of maintaining its elasticity for several days after being embedded in the tissues. It must be exceedingly adhesive and capable of thorough sterilization. It seemed to me that, if the adhesive mixture used in the preparation of the well-known zinc oxide plaster could be spread upon thin strips of pure rubber, it might succeed.

After some correspondence with the firm of Johnson & Johnson, of New Brunswick, New Jersey, I had an interview with their chemist, Mr. F. B. Kilmer, who thought that such a material could be made, and that it could be thoroughly sterilized by formaldehyde vapor. After a number of experiments, he finally sent me a sample which seemed perfectly to fulfil the requirements.

Owing, however, to a change in my hospital work and other circumstances which seriously interfered with my plan of animal experimentation, the plaster was laid aside, and nothing was done with it for three or four years, when another similar experience again brought the matter to my attention, and emphasized the necessity of devising some new means of treating these cases.

The second experience occurred while assisting another surgeon perform an amputation of the breast for extensive malignant disease. After cutting off a number of the branches of the axillary artery, and while clearing away a mass of glands and infected areolar tissue surrounding the vessels high up under the coracoid process, he accidentally plunged the point of his scalpel into the axillary artery, inflicting a wound nearly half an inch in length.

In this instance I was able to successfully suture the wounded artery, and the circulation in the extremity was not impaired. Had the vessel wall been diseased, or had the tension been greater, the suture would have failed as in the other patient; and, as most of the anastomosing branches had already been sacrificed, the result of ligation would probably have been disastrous.

Shortly after this last experience, I decided to make a series of animal experiments with the plaster.

These experiments were carried out at the Surgical Laboratory of the College of Physicians and Surgeons, where I was assisted by Dr. J. W. Draper Maury and Mr. Gordon, one of the third-year students, to whom I am also indebted for the postoperative notes on the various animals and for the preparation of the gross specimens.

The following is the technique usually employed: The animal is etherized, the wound area shaved and scrubbed with green soap and hot water, then douched with ether, and a 1 to 1000 solution of bichloride. An incision is then made exposing one of the large arteries, the usual aseptic technique being followed.

As soon as the artery is exposed, it is brought to the surface of the wound and incised with the point of the scalpel. The vessel is then compressed above and below the wound, to prevent excessive hæmorrhage, and the sheath carefully removed. The artery is next cleansed of all blood by the use of a small pledget of gauze moistened with ether. As the ether evaporates, the vessel wall is left clean and dry.

A small strip of the plaster is next passed beneath the vessel, and the two corners held by two small artery clamps in

the hands of an assistant. (Fig. 1.) The strip is then put gently on the stretch and the lower extremity of the strip held by the clamps placed firmly in contact with the vessel, while the upper extremity of the plaster is slowly drawn upward. This causes the vessel to rotate with the plaster until the horizontal edge of the lower extremity of the plaster is on a level with the vessel and firmly adherent to it. (Fig. 2.) The two clamps are then passed over the vessel (Fig. 3) and the plaster kept on the stretch while the operator, with his thumb and forefinger, gently rotates the vessel backward, and at the same time compresses the enveloping plaster until it adheres snugly. The redundant plaster is then removed and the vessel allowed to fall back to its normal position in the wound. (Fig. 4.)

As soon as pressure on the vessel is relieved, the circulation is at once restored, as evidenced by the return of normal pulsations in the distal portion of the artery.

The vessel is then watched for a few moments to see if the plaster remains firmly adherent after pulsation has reappeared. The wound is closed without drainage and a gauze and collodion dressing applied.

The wounds, as a rule, heal kindly, suppuration having occurred in only two instances.

The following is a description of the various experiments and the results:

EXPERIMENT I.—A medium-sized dog was etherized, and the left femoral artery exposed in its lower third. The vessel was not at first recognized, as the writer was not familiar with the bluish color of the arteries in these animals. It was carelessly injured, and later double ligated and divided between the ligatures. Another incision exposed the artery one and one-half inches above. A longitudinal cut was made in the vessel about one-quarter of an inch in length, the plaster applied as described above, and both wounds tightly closed.

EXPERIMENT II.—The right femoral of the same dog was exposed, wounded and treated in the same manner, followed by complete closure of the wound and the application of a cotton and collodion dressing.

The dog recovered from the operation and seemed in his usual spirits the following day. He continued to do well for ten days, when the lower wound on the left thigh became red and inflamed. Two days later an abscess ruptured. On the morning of the thirteenth day the dog was found

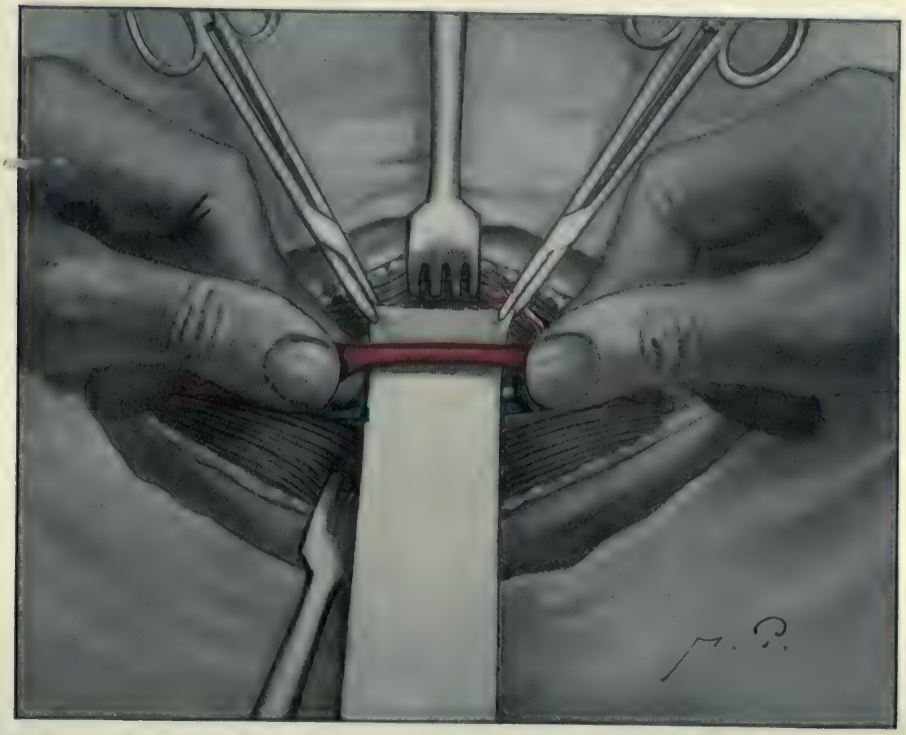


FIG. 1.—The elastic plaster is being drawn through beneath the artery.

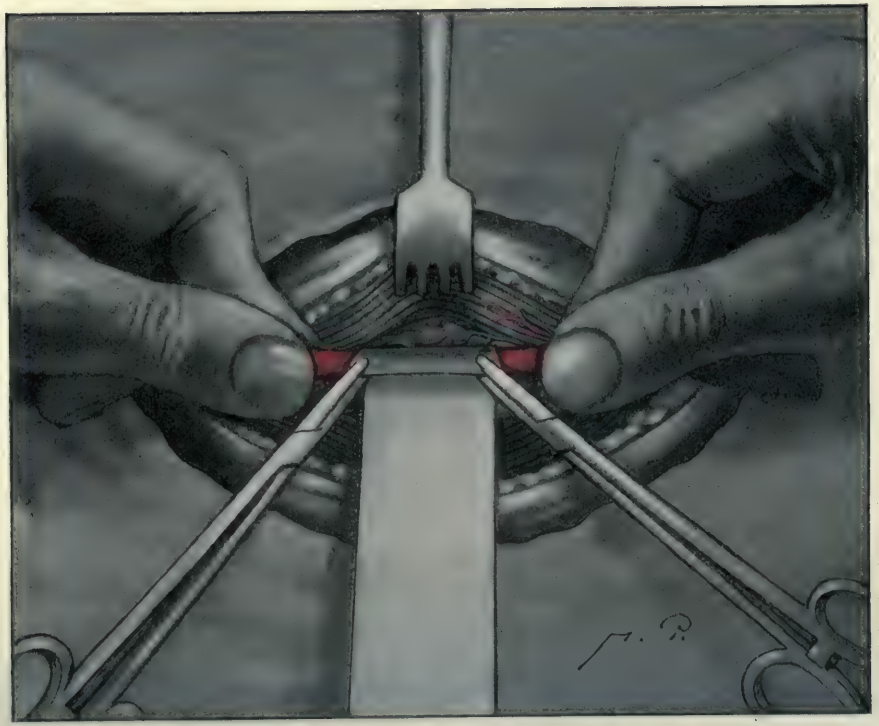


FIG. 2.—The extremity of the adhesive strip is brought in contact with the artery.

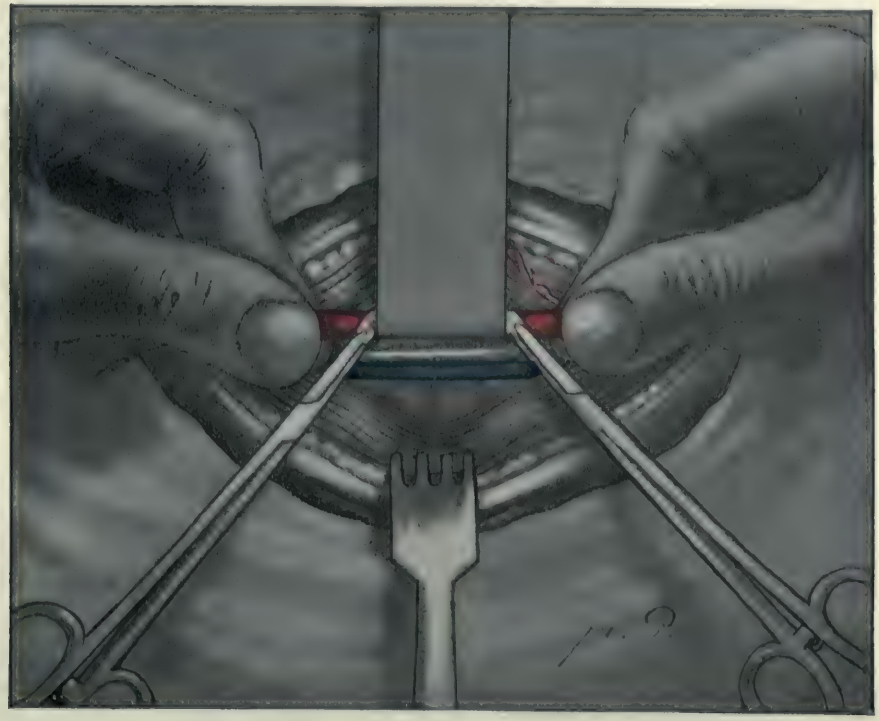


Fig. 3.—The plaster is made to adhere to the artery.



FIG. 4.—The redundant plaster has been removed, and the artery with its collar of plaster allowed to fall back into its normal bed.

dead in his cage, lying in a pool of blood, due to secondary hæmorrhage from the lower infected wound. Autopsy showed the upper wound in the left femoral completely closed and the plaster embedded in the surrounding tissues. The lower portion of the artery near the ligature had sloughed, and the dog had bled to death through the femoral artery, conclusively demonstrating that the vessel had remained patent at the seat of the longitudinal wound. (Microscopic sections of both specimens exhibited.)

Examination of the right femoral artery showed that the plaster had become slightly loosened at one point, and, although the wound in the vessel had healed, the lack of support had resulted in the formation of a saccular aneurism. The lumen was patent throughout.

Experiment III.—A small fox terrier was etherized. Right common carotid exposed by a three-inch incision, the vessel punctured, and the wound closed with the plaster in the usual manner; circulation re-established, and the cutaneous wound united with a continuous suture of fine silk.

Experiment IV.—Same animal. The left common carotid was exposed by a separate incision, punctured and closed in the same manner; circulation re-established in the vessel, as evidenced by return pulsations throughout its entire exposed portion. Wound closed and dressed.

The dog recovered from the anæsthesia and showed no sign of discomfort. Two oval swellings appeared over the wounds. There was, however, no tenderness, and the stitches were removed on the fifth day, the swellings having largely subsided. Primary union throughout. Later, the swelling returned over the left wound, and the seventeenth day the wound opened and a small amount of bloody serum was discharged. No pus or redness of the tissues. The wound healed promptly, and the dog continued in excellent health and spirits for over three months, when he was again etherized, both carotids exposed by incision, and on gross inspection no sign of a wound or of the plaster could be detected. Both vessels pulsated normally and equally throughout their entire exposed areas. The vessels were then divided well above the original wounds and the animal allowed to bleed to death. Both specimens were then removed and found to be patent. (Specimens exhibited.)

Experiment V.—Medium-sized mongrel dog was etherized, and an incision four inches in length made through the left rectus abdominis muscle below the umbilicus. On opening the peritoneal cavity, the intestines were drawn aside and held by sterilized gauze pads, exposing the abdominal aorta. A point was chosen just below the origin of the inferior mesenteric artery, the peritoneum incised, and the areolar tissue and sympathetic fibres removed from the vessel for a distance of one inch.

The artery was then drawn upward and held by the fingers of an assistant. An incision was made with the point of a scalpel through the anterior wall of the vessel, from one-quarter to one-half an inch in length, through which a stream of blood issued with considerable force whenever the proximal pressure was released. The artery was then thoroughly cleansed and dried with gauze pads moistened with ether, the plaster tape applied in the usual manner, and the peritoneum united over the vessel.

Considerable difficulty was experienced in applying the plaster, as it was impossible to raise the artery more than a short distance from the spinal column, owing to the presence of the numerous lumbar branches. The abdominal wound was closed by two layers of suture, and a cotton and collodion dressing applied, which was reinforced by a tight abdominal binder.

At the close of the operation distinct pulsations could be felt in both femorals; and the extremities, which during the operation had become quite cold, soon regained their normal warmth.

No untoward symptoms followed the operation. The dog was up and walked about his cage the following day, and from that time on appeared in good health and spirits.

He lived three months and two weeks, and was then killed for the specimen. On autopsy the vessel at the point of operation was surrounded by a rather dense layer of areolar tissue which completely embedded the plaster. The vessel was thoroughly patent. (Specimens exhibited.)

On all of the animals reported thus far, the first specimen of the plaster furnished by Johnson & Johnson was used. The plaster was exceedingly thin and very adhesive, although its elasticity had been somewhat impaired by the three years it had lain in my desk drawer. That fact was, in the writer's opinion, an advantage, for it could be snugly applied without producing too much pressure on the vessel.

A second specimen of the plaster furnished by Johnson & Johnson for experimental purposes was somewhat heavier and decidedly less adhesive. When applied with the same degree of tension, it caused much greater pressure on the vessel, frequently leading to a narrowing of its lumen, and occasionally to the formation of a clot, even when the vessel wall was not punctured.

EXPERIMENTS VI AND VII.—Same dog as in Experiment V. Both common carotids exposed through a single median incision, sharp longitudinal incision made in each, which was afterwards closed with the heavier plaster. In this instance it was necessary to moisten the adhesive surface of the plaster with ether in order to insure firm adhesion. It was also necessary to hold the plaster in place much longer than in the other experiments. When it was seen that adhesion was firm and that the artery pulsated normally, the wound was closed and dressed in the usual manner. No reaction followed the operation, the wound healed primarily.

Three and one-half months after the operation the dog was killed and the arteries examined. Each was surrounded by a layer of fibrous tis-

sue which completely embedded the plaster. Both arteries were patent. (Specimens exhibited.)

EXPERIMENTS VIII AND IX.—Small dog, median incision. Both carotids explored, incised, and the wound closed with heavy plaster. No reaction. Dog appeared in excellent spirits on day following operation, and continued well until the thirty-fifth day, when he was killed and both arteries removed.

On examination, both arteries contained firm clots; but as they were immediately immersed in a strong solution of formalin after removal and before any examination was made, it is probable, in the absence of any cerebral symptoms, that the clots were of post-mortem origin. (Specimens exhibited.)

EXPERIMENTS X, XI, XII, AND XIII were upon dogs which were at the same time operated upon by another member of the Laboratory Staff, who performed on each a gastro-enterostomy by a new method. Both dogs died of peritonitis, one on the fourth and the other on the fourteenth day. Both carotids were opened and repaired by the heavy plaster.

On autopsy, only one of the carotid wounds was infected. All four arteries, however, were filled with firm clots.

EXPERIMENT XIV was upon a dog also employed for a gastro-enterostomy on the same day. Only one carotid was opened and closed with the plaster. He made a good recovery, but had a very considerable hæmatoma at the site of operation.

As six of the eight experiments with the heavy plaster had upon autopsy shown the vessel to be occluded by a clot, and as none of the animals upon whom the first specimen of plaster was used had presented occluded vessels, it was thought that the trouble was due to the greater degree of pressure exerted on the vessel wall by the heavy plaster, or perhaps to the greater amount of digital compression used to insure firm adhesion.

To verify this, Experiment XV was performed, which consisted simply in exposing the remaining common carotid in the animal used in Experiment XIV, and applying the heavy plaster without wounding the vessel.

On autopsy, both arteries were found to be filled with firm clots, which leaves very little doubt but that the pressure, and not the method, is responsible for the thrombosis.

In the writer's opinion, these experiments demonstrate that, in dogs at least, small wounds of the larger arteries can be successfully treated by the application of an aseptic elastic

plaster. That this plaster should be exceedingly thin, very adhesive, and applied with the minimum of pressure on the vessel wall; and that, if the operation is carried out with perfect aseptic technique, the plaster becomes embedded in the tissues and produces no untoward symptoms.

The writer has had no opportunity of trying this method on the human subject, but would not hesitate to do so if an occasion presented.



FIG. 1.—Family E., photographed July, 1904.

T. E., aged 4½ years; operation at 2½ months.
M. E., aged 2 years; operation at 2 months.
Baby E., aged 5 months; operation at 1 month.



FIG. 2.—Baby E., before operation.

The cranial depressions in the three infants were similar in site and dimensions.

BIRTH-FRACTURE OF THE SKULL.

FAMILY OF THREE, ILLUSTRATING THE EFFECTS OF OPERATIVE TREATMENT.

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FIG. 1 is a photograph of a family, taken recently, to which are appended the respective ages, and the dates of operation. All presented a depressed (greenstick) fracture of the skull in the left frontal region, the result, apparently, of injury by compression against the maternal pelvis during delivery. Fig. 2 is a photograph of the youngest member of the family, and a photograph of the second child (forming one of a series of such cases) will be found in the *British Medical Journal* for December 19, 1903. The site, size, and shape of the depression were practically identical in the three.

None of the three had been treated at birth by Munro Kerr's manual moulding method. None showed evidence of spontaneous improvement, though the eldest was kept under observation for two months before operation.

Operations and Results.—In the case of the eldest, operated on some four years ago, the depression was elevated by metal elevator and bone hook. It proved, however, so resiliant that, while it was comparatively easy to elevate it, it was impossible to prevent the bone springing back into its former depressed site. An attempt to obviate this tendency by over-correction of the deformity resulted in the area of bone breaking up into several segments, and, as each of these still remained depressed against the dura, they were excised. The result in this case is a gap in the bony skull, which, though lessening in area by growth of the surrounding bone, still exhibits cerebral pulsation in an area of about three-quarters of a square inch.

In the case of the two younger children the method of operation followed was inversion of the depressed areas of bone, measuring respectively two and two and a quarter inches in diameter.

The result, in both cases, was the usual rapid union of the young growing bone (union firm at the end of one week, when the scalp sutures were removed), with complete correction of the deformity.

Remarks.—Depressed (greenstick) fracture of the skull is comparatively common in infants and young children. I have treated by operation twenty-three such cases. Of these five were traumatic, from falls or blows after birth, and eighteen the result of difficult labor. The ages at operation of these cases ranged from three weeks to eight years.

In symptomatology the cases have varied. In a number, apart from the deformity, there have been no symptoms. In two there were "convulsions," doubtfully due to the depression, and persisting in one after successful operation for the deformity. In two others epileptiform convulsions were, also doubtfully as the convulsions were general, attributed to the depression. Both of these cases were, apparently, cured of the epileptic affection, but at a period so long after remedy of the deformity that it is reasonable to view the recovery as quite as probably due to the lapse of time and the medical treatment carried out as to the operation. In one, a child of three, there was acute tenderness over the depression, which disappeared after operation. In another, a child of five years, there is mental deficiency. This is said by the parents to have shown marked improvement since the operation, some two years ago, so much so that recently at the urgent request of the parents a similar area on the opposite side of the skull was dealt with (on this occasion by craniectomy), with what result is not yet apparent. One case presented a fluid swelling, occupying part of the depression, and becoming tense when the child cried or struggled. At the operation this was found to be a collection of cerebrospinal fluid under the pericranium communicating with the subdural space through a linear gap in the bone and dura over the dome of the depression. This case, and three others, presented laceration of the dura, patent or healed. In the majority of the cases the dome of the depression when excised (*i.e.*, the internal table) has presented either

actual greenstick splintering or evidence of that having taken place.

The Method of Operating.—In the earlier cases this was by elevation, and in these cases various methods were practised. In some the scalp was raised as a flap, or by linear incision; in others simply punctured to admit an elevator or other instrument. In some the elevator was introduced under the depression from a small aperture made in the bone near the periphery of the depression or through a neighboring suture, in others the bone hook or other instrument was introduced through an aperture made in the centre of the depression. In some the depressed area was dealt with as a whole, in others after being cut, crucially, into quadrants. Of such methods practised in very recent cases, very young infants with pliant bones, and before the deformity has become "set," I have had no experience. In the cases with which I have dealt (ranging from two months to eight years after the injury) the results of such methods have been disappointing, so much so that I gave them up, and in two cases (*vide Glasgow Medical Journal,* February, 1901) excised the major portion of the depressed bone.

In the last ten cases operated on the method employed has been inversion of the depressed area. For the purpose I employ circular, parallel-sided trephines, ranging from one and a half to two and a half inches in diameter. These trephines are armed with rim-flange stops or guards adjustable by screw, which permit of rapid cutting without risk of injury to the dura. In one of the cases I made use of a Stelwagon trephine, cutting out a disk of three and a quarter inches diameter. For future trial in such cases, Messrs. Down Brothers have fitted for me a Stelwagon trephine to a steel brace. It is in no way detrimental to the reputation of an instrument intended for cutting semicircles to say that for cutting circles Stelwagon's trephine is inferior in speed and safety to a circular trephine with flange guard. It is, however, a simple and cheap instrument, which, with care and time, may be made

to cut a circle in the child's skull of any size up to, at least, four inches diameter.

The steps in the operation are, briefly, (1) Expose the depressed area by reflecting scalp and pericranium together, by flap or linear incision; (2) cut out the depressed area by the trephine; (3) invert it on a sterile swab or towel, and by thumb pressure reduce the bend as far as may seem to correspond with the natural curve of the skull; (4) replace it, still inverted, on the dura, and (5) secure the scalp over it by means of silkworm sutures, leaving sufficient space here and there between the sutures for natural drainage.

The rate of union of the inverted disk is rapid. In all ten cases bony union, so far as palpation demonstrated, was firm at the end of a week, when the original dressing was removed to withdraw the scalp sutures.

The operation is trivial. Of the ten cases, seven were treated throughout as out-patients after operation, two of the seven being the youngest members of the family E. (Fig. 1.)

Conclusions.—A survey of the literature available, and the experience of a number of cases seen, and particularly of the twenty-three cases operated on, appear to me to warrant the following conclusions:

(1) That the statement made by a number of authors to the effect that, in the majority of cases, depressed greenstick fracture of the skull in infants rectifies itself if left alone, lacks substantiation. It is certainly no more true of the traumatic (as opposed to the parturition) greenstick fracture of the skull than it would be if made of any other greenstick fracture in the body. In regard to the parturition cases it may be true of some, viz., the slighter, cases of indentation, which may spontaneously disappear within a day or two of birth. In the more marked cases I cannot but regard such a statement as misleading. In cases over one month old, after the deformity has become "set," its spontaneous obliteration must be regarded as problematical, and as being, at best, both slow and partial.

(2) That in cases of greenstick depressed fracture of the

skull in infants and children which have not, when recent and soft, been remedied by Munro Kerr's method, operation is justifiable even if only for the correction of deformity. The excision of a nævus of the face or a small keloid scar from the neck is an everyday surgical procedure. The deformity of a cranial depression is quite as unsightly as either, and is the cause of much more anxiety to the parents, who attribute any little real or imaginary eccentricity of the child to his "queer head," while the operation for its correction is no more serious than is the removal of the nævus or the keloid. The twenty-three cases on which I have operated recovered without a death, many of them as hospital out-patients.

(3) That of the two methods available, elevation and inversion, the latter is decidedly the better, alike in the freedom from risk and the perfection of the result obtained.

DIVULSION IN ŒSOPHAGEAL STRICTURES BY MEANS OF A NEW INSTRUMENT.

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In the February number of the ANNALS OF SURGERY, 1904, there appeared an article by Dr. Rilus Eastman, upon the treatment by direct dilatation of cicatricial œsophageal stricture.

In substance, bearing in mind the extreme variability of the anatomical conditions resulting from wounds or burns or other processes that finally bring about a stenosis of the œsophagus, variability either in the displacement of the lumen, or in the extension of the strictured part, or in the irregularity of the stenosed passage, he recognizes how badly the ordinary olive-pointed dilator answers in certain cases, since the position in the gullet of the olive-pointed dilator of a hard-rubber olivary bulb (page 166) attached to a springy whalebone shank cannot be controlled by the operator. (*Treatment by direct dilatation of cicatricial œsophageal stricture,* ANNALS OF SURGERY, February, 1904.)

The same objections may be made to the spiral metallic sound of Cracour and to dilators of woven tissue or of caoutchouc. Especially if the stricture has a valvular form and disposition—and examples of this are not wanting—is it extremely difficult to pass the stricture and to proceed with the gradual dilatation by the ordinary method.

He therefore proposes to use, and has used with success, elastic, malleable sounds formed with thin, smooth, metallic spirals or of web-silk containing withdrawable lead core.

By curving the extremities in various ways, we can with these sounds experimentally pass a stricture, just as is often done in strictures of the urethra, by means of filiforms whose

points can be variously bent or twisted into spiral or corkscrew form.

And the comparison is the more exact as the author proposes in certain cases to screw the extremities of an ordinary metallic œsophageal sound to the head of his special filiform sound, and so push it into the stomach, passing the stricture precisely as we do with the filiforms and with the divulsors or urethrotomes in urethral strictures.

And the author has also constructed a dirigible metallic sound whose point can be turned at will by means of a screw which is in the handle, almost as we turn the lever in the cystoscope with the urethral catheter, and can then be guided after various attempts to pass an œsophageal stenosis.

It is, however, easy to understand that this instrument must be of much less practical utility than the first described filiform sound.

When this article appeared, I had under my care at the Hospital of San Giacomo a patient, whose history I shall relate later on, suffering from severe and extended œsophageal stenoses impassable by the ordinary sounds or the olive-pointed dilators, which fact had already made me design and employ a new instrument.

I agree with Dr. Eastman that the only way to overcome the stenosis in these cases is by means of very fine ductile sounds, whose extremities can be directed in various ways, and when used by a practised and careful hand, trying, I would almost say, testing, the œsophageal walls in their different segments, they may succeed in threading the restricted and often decentralized passage, or in overcoming the valvular formations that arrest the ordinary sounds.

As a rule, we do not act otherwise in the case of stenosis of the urethra, and the resemblance is obvious, making allowance for the greater difficulty of manipulation in the œsophagus.

And this purpose, I agree with the author, may very well be answered by the filiforms he proposes, whether metallic or elastic, with lead core or not.

But also ordinary whalebone filiforms with varying points

will answer very well, especially with a very small metallic terminal olive screwed to the end of a little metallic ring, precisely as is done in manipulations with the urethra, when often, after repeated attempts and sometimes after several sittings, of course always careful and cautious, we at last succeed in overcoming a stenosis that resists other ordinary olive-fitted sounds.

But yet to succeed in passing with a thin whalebone string, or with a filiform sound, as proposed by Dr. Eastman, is often less than nothing, since the success is not easily repeated, nor can it be followed up with a thicker sound, and the treatment is not advanced a step.

But the filiform introduced may serve as a guide precisely as happens in the case of the urethra, and as in the latter, so in the case of the œsophagus, one could slip in either hollow elastic sounds open at the end like those of Patamia for the bladder, or, as Dr. Eastman suggests, screw a spiral metallic sound on to the end of the filiform, and, driving this into the stomach, pass the stricture with a thicker sound, or finally use filiforms to conduct one of the recognized cutting instruments across the strictured point.

The first two means are often difficult to employ, and when forced may become dangerous. We know this in the case of the urethra, where the manipulation is more external, more easy, and is controlled both by the eye and the fingers.

The so-called internal œsophagotomy is an operation which, since 1861, when Maisonneuve boldly practised it for the first time with his instrument, although not very frequently used, is found described and accepted in all treatises of operative surgery. Maisonneuve's instrument is of construction similar to his urethrotome (only naturally it is longer and somewhat thicker), is provided with a conductor, and cuts from above downward, with a blade of triangular anterior point and two sharp sides. It gives no certainty of the depth of incision, and, further, in a case of partial stenosis, may cut also on the other side, producing unnecessary lesions. For the same reason we must reject the "anterograde" œsophagotome of Lannelongue, which also cuts downward; the author used it with good success in one case.

That of Dolbeau, on the other hand, cuts upward, and is constructed with a terminal sphere ending in a conical point, the sphere being six millimetres at the base, and the two blades cutting laterally; the blades are made to open by means of a mechanism in the handle; as soon as the olive which covers them has passed the stricture and in drawing up they are arrested on the strictured point; the opening of the blade is in proportion to the diameter of the sphere, therefore all danger of cutting too deep is excluded.

More in use (Trélat, Tillaux) is the Trélat œsophagotome; and even nowadays it is recommended in preference to others (see Monod and Wanwärts). It is made with a curved rod having an inverted olive at the end, that has to pass across the strictured point, surmounted by an enlarged part that touches and stops on the stricture itself. In the terminal portion there are two sheathed blades as in the hysterotome of Weber, which, by means of a screw in the handle of the instrument, can be made to open, while the extent of the opening can be graduated according to a little index near the screw from one to twenty millimetres in length.

In using this instrument, it is recommended, first, to determine the distance of the strictured point from the incision by means of an ordinary olive-fitted sound, and, having marked this point on the rod of the instrument, introduce it as far as the point marked, pass the stricture, turn the screw, opening the blades more or less according to the circumstances, draw the instrument up some centimetres, close the blades by turning the screw in the opposite direction, and withdraw the whole instrument.

In this way it is said the stricture is cut from below upward with precision to the depth required, and in the exact point predetermined.

But it is first of all necessary that the terminal olive part can pass the stricture, and when this is possible, we could do without the œsophagotome; and it is also necessary that the stricture be only one and small; and even in these cases all inconvenience is not excluded, since, when used by Trélat himself

with an opening of the blades of twenty millimetres, a serious hæmorrhage occurred (*Gaz. des Hôp.*, 1870, p. 115). Studsgaard used an instrument fifty centimetres long, which carried an elastic conducting sound with a button at the end and a cutter within a pair of steel tongs, out of which it could glide, this cutter measuring one centimetre in diameter at its greatest breadth.

Czerny used an œsophagotome constituted on the model of Ivanduch's urethrotome, only longer. The instrument was introduced closed, and the stricture was cut from below upward, the cutting blade extending about two millimetres from the sheath.

Sands also proposed a new œsophagotome constructed after the type of the urethrotome. To obtain both the incision and the dilatation from the strictured point, the blades are hidden in split olives. The stem of the instrument is formed of a hollow spiral, through which run two thin metal threads connected with the blades; these by a movement of a screw leave the olive, while an indicator gives the depth of the incision. A movable ring on the rod serves to mark the distance of the stricture from the incisors.

Le Dentu, who thought the instrument of Trélat useful, when it could be used, in a case of his, in which the contraction was too narrow to admit Trélat's conductor, reverted to the double-bladed œsophagotome of Maisonneuve, the comparatively thin conductor of which can pass into an œsophagus where No. 11 or 12 urethral sounds could pass.

Yet he says textually, "avec ses lames formidables c'est un instrument dangereuse qui a fait ses preuves dans se sens." He modified it, therefore, preparing six blades, graduated in three pairs, five, seven, and nine millimetres in width, so that combining them differently he could obtain incisions of from twelve to twenty-one millimetres.

He used it in a case in which the stricture had extended far, and could only be passed by a urethral sound, No. 11; Trélat's instrument he could not use. With his own instru-

ment he was able first to make an incision with two blades, No. 1, and then with one blade, No. 1, and one No. 4.

Then the invalid, who was wilful, insisted on leaving the hospital, and we know no more about him. The success, therefore, remains incomplete.

Schlitz has an instrument that was used by him in three cases with success, and in two others by Kölliker (see Weber). It is a hard gutta-percha tube with one of the usual hollow sounds, sixty-eight centimetres long and twenty millimetres in circumference, with its lower extremity blunt, girt three centimetres above this point with a metallic sheath, split lengthwise, from whose cleft the knife issues when required. The knife is moved by the hand working a metal thread that passes inside the sound, and at will the knife is made to escape from its sheath and return into it. It is governed by means of a screw that lengthens and shortens the metal thread, and so causes the knife fixed at the end to issue more or less from its groove. Besides this, the external extremity of the sound has an eye that stands in the longitudinal axis of the instrument, and is always on the side opposite the blade at the other extremity of the sound; so the operator may know in what direction the incision is being made. The greatest distance that can be obtained between the point of the blade and the axis of the instrument, by means of the screw, is seventeen millimetres. This œsophagotome is used in the "retrograde" way (cutting on withdrawal). When, therefore, the sheath with the cutter is passed across the stricture, the screw is turned for the exit of the blade to the extent desired, and the instrument cuts as it is drawn up. For further particulars, Weber's article should be consulted. But it is not of great importance.

The important thing is that these are all dangerous instruments, especially, and all agree in this, those that cut downward, even when guided as Maisonneuve's and Lannelongue's, and also that modified by Le Dentu, and therefore almost everybody rejects them. Monod and Wanwärts include Reybaud's instruments among the dangerous ones.

The so-called "retrograde" instruments have the initial

and formidable defect that the restriction must be penetrable by instruments of a certain diameter. Trélat's has four millimetres diameter in its narrowest terminal portion, Schlitz's has six and a half. And then they are dangerous. In a case of Trélat's own, and in one of Schlitz's, there was hæmorrhage after the operation, and in a case of Czerny's there was death. Besides, as I have said, if in a case of stricture you can pass an olive-fitted sound of four or six millimetres, we may say such a case is absolutely exceptional, if one could not succeed as well by gradual dilatation, which is naturally far preferable to all other methods in the treatment of œsophageal stenosis.

There are some cases, as I hinted at in the beginning, that only allow the passage of filiforms, and these not easily and not always; so that it is not possible to pass every day and effect a regular progressive dilatation; and for this it is often necessary to try over and over again, and to use fine whalebone sounds, bending them in various ways, and resorting to artifices; and in these cases, when we have once passed, there immediately arises the necessity and the desire that this laboriously obtained result shall not become useless through the withdrawing of the sounds, which who knows when we shall succeed in reintroducing; and it is rather desirable to use them as a guide to obtain a rapid dilatation that may permit of the entrance of thicker sounds so as to continue then the daily dilatation with less difficulty with the ordinary sounds.

Durante, several years ago, for a case of this kind, designed a special olived œsophagotome, cutting from above downward and guided by whalebone strings. The instrument consists of a thin whalebone guide (Fig. 1), the extremity of which is provided with a little metallic olive, not more than one or two millimetres in diameter, and whose length must be great enough to allow of a second string being screwed on to the first with a little metallic ring. When the guide has been introduced across the stricture, the essential part of the instrument slips on to it, consisting of a conical metallic olive, whose greatest diameter is from six to eight millimetres, furnished with three embedded cutters like those of Maisonneuve's instru-

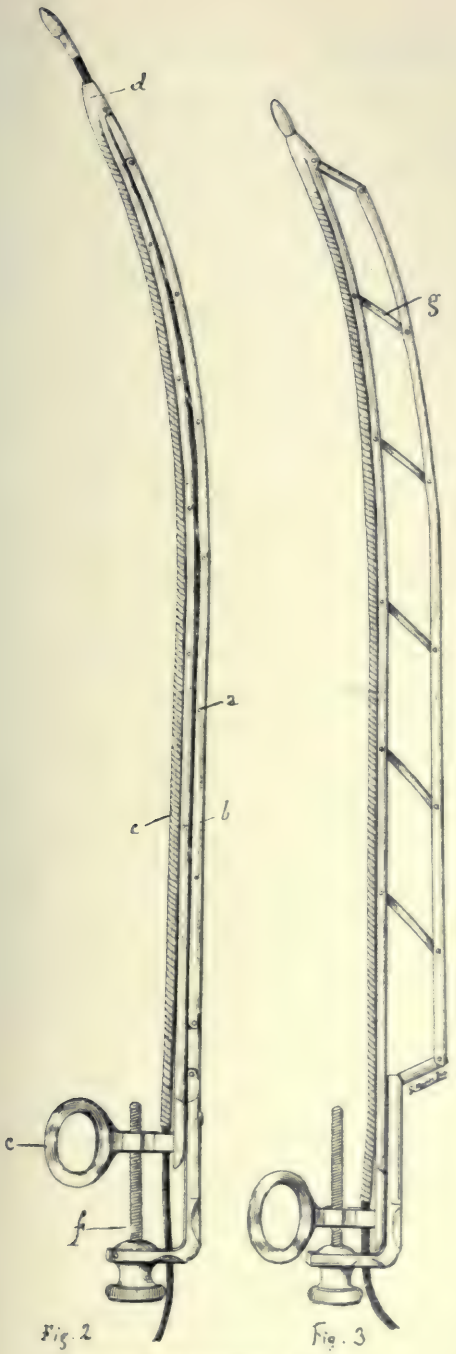


Fig. 2

Fig. 3

The œsophageal divulser of Alessandri.

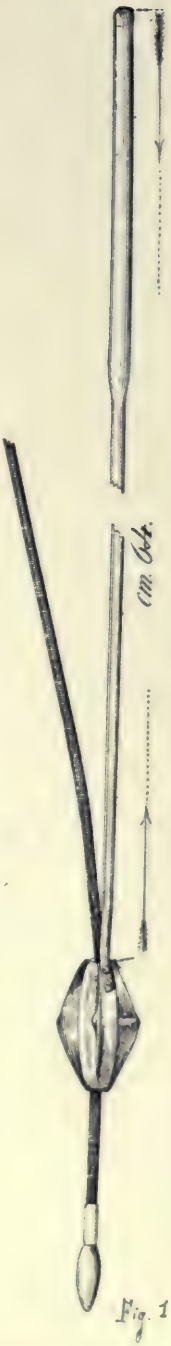


Fig. 1.

The œsophagotome of Durante.

ment, but smaller, and only from three to four millimetres when at their extreme height. The olive is fixed on a thin flexible metallic stem, and is pierced down the middle so as to be threaded on the guide and pressed down upon it by means of the flexible metallic handle as far as the strictured point that it is forced to pass, partly tearing and partly cutting it.

In two cases Durante applied it with success. In a case that came under my care last winter, in my department of the Hospital of San Giacomo, I wondered if I could not with greater safety have recourse to an œsophageal divulsor, in the same manner as is daily done for the urethra. Here also we must recognize the difference of opinions in favor of the urethrotome or of divulsion.

It is certain that divulsion gives excellent results, provided one does not try to get too large a dilatation at first, which may cause laceration and infiltrations, and which, above all, is not necessary, because a moderate divulsion is enough to allow of the subsequent easy passage of sounds, gradually increasing in thickness and the safe reaching of the degree of dilatation desired.

I do not see why we should not try to obtain the same results in the case of the œsophagus. Yet divulsions in the case of œsophageal stricture is never mentioned in treatises of surgery or in special memoirs, or if spoken of is rejected.

Albert says it is an operation so dangerous that it has justly found no advocate. He says we may have laceration of the œsophagus or necrosis even of small points with consequent ichorous infiltration. And he mentions the figures of the dilators of Le Fort and Demarquay, which have the very great fundamental defect of the retrograde œsophagotomes above-mentioned, that is, they are not guided, and have such a diameter that they cannot pass across a severe, extended, or irregular stenosis without danger, and for such stenosis, where they can pass, the same Albert's observation is justified that equally good results can be obtained by gradual pressure of a conical sound.

König mentions and gives figures of Fletcher's dilator, which has three arms, varying according as a button that is

placed between them is pulled; and also he mentions a parallel dilating sound of Schützenbergh and a pincette with branches, that open parallel to each other, of Broca.

v. Hacker mentions the instruments of Collin, Vidal, and Leube. He also describes those of Jameson, Bruns, and Svitzer, which, however, are only artifices for a graduated dilatation, and cannot be called divulsors. They are modifications of the ordinary olive and crescent dilator of Tillaux.

That of Jameson (see figure in König) is formed of a whalebone rod, bearing an ivory olive at its extremity. The olive is pierced lengthwise to allow the passage of a little metallic rod with a button, this rod serving as guide. Rather than a divulsor, it is a guided olive dilator.

That of Bruns (figure in König) is the same in conception. Upon a guide three millimetres in thickness, on to which a little ivory sphere of five millimetres can be screwed, guides are driven by means of a threaded sound, or wedges of ivory of various sizes with a special propeller and two threads are fixed to them to withdraw them after having left them for a long time. Instead of the guides, we can use silk thread, to which a little sphere is attached, that the patient swallows, and which passes the strictured point.

Svitzer in the same way passed the strictures with ivory olives fixed to a thread, introduced by means of a whalebone sound that was fastened in the hollow of an olive, and then with a twist movement freed itself, and was withdrawn, and the patient then by drawing a thread could extract the olive.

In the same way, but with the object of maintaining it there for a greater or less length of time, and so assure nutrition, small cannulas are introduced fixed to threads, so completing a kind of intubation.

As is seen, all these are means that differ little from the ordinary graduated dilatation by means of sounds or olives, or are modifications of it, and they are more or less successful artifices.

Senator with a sound introduces a little cylinder of laminaria attached to a thread and leaves it for more or less time,

at the most an hour; but the strength of the dilatation cannot be controlled.

Schreiber fixes a little tube of caoutchouc, hermetically sealed with sealing-wax, on a whalebone filiform, projecting from an œsophageal sound, to which it is also fixed. When it is in the strictured part, tepid water is introduced, and the tube is distended and the strictured passage can be widened. Reichman and Russell use similar instruments, however, with air pumped in instead of with water.

As von Hacker observes, the minimum of diameter of the instruments is, however, three millimetres; and so they do not serve for very severe strictures.

As a sample of general opinion we can refer to that of Albert, who, after having equally rejected divulsion and internal œsophagotomy, says that the safest process is with external œsophagotomy and gastrostomy.

But the laceration and neurosis he fears in divulsion may arise only if one pushes down the instrument blindly, and if in the divulsion we exaggerate and try to obtain at once an advanced dilatation.

Of course, these dangers are not smaller with any kind of œsophagotomes. Several of them dilate beside cutting, and the incisions may often give rise to serious hæmorrhages (as in the case of Trélat and Schlitz); nor do we often know in what direction the incision or incisions will occur, and even in those instruments, such as those of Schlitz, in which this is indicated, we gain very little when we consider we do not know in what part the cicatrization of the œsophageal wall is thickest.

External œsophagotomy answers well in certain special cases, always in the cervical region, for no one thinks of practising intrathoracic œsophagotomy for simple stenosis.

As to gastrostomy, there is universal agreement that it is necessary in certain cases where the stricture is not passable, and it is imperative to nourish the patient, that his general conditions of health may be sustained.

It will be then in these cases an excellent preparatory

operation, since it only serves to permit tranquil manipulation and to increase the hope of success in passing the lateral stricture, and then closing the gastric fistula.

Or it may serve for retrograde catheterism, and certainly this is a method that has often given excellent results, when in no other way an œsophageal stenosis, especially a low placed one, could be passed. I do not wish here to enter upon the subject of retrograde catheterism, which would take us too far from our subject, and which, any way, is certainly a process to be reserved for certain special cases.

In the case I have referred to, and of which I will now give in brief the clinical history, I did not find myself urged to gastrostomy, or to attempting retrograde catheterism, since, although, for many days, the stricture was not passable by even the finest sounds, and, above all, did not lend itself to a gradual regular dilatation, for although, one day, I did succeed in the insertion of a string, I did not succeed either in proceeding further in the same sitting, nor in the following days did I often succeed in re-introducing the same sound, yet, all the same, liquid passed, and nutrition went on sufficiently satisfactorily.

And therefore, while I deferred, if necessary, recourse to gastrostomy or to a trial of retrograde catheterism, I thought this was just the occasion to force the constricted part so as to permit the passage of gradually enlarged sounds.

I confess that I had no disposition to use any of the recognized œsophagotomes, nor yet that of Durante. The length and the irregularity of the constricted part, evident from the great difficulty in the introduction of a simple whalebone string, led me to believe that the cuttings would be uneven. and the œsophageal wall would be variously interested.

And all the dangers mentioned above of the various œsophagotomes of anterograde type—since there was no question of the retrograde—made me abstain from using them.

I devised and had constructed by Invernizzi, of Rome, an instrument of the type of the urethral divulsor of Oberlaender, of which there are two forms, an original and a new one, or

of the divulsor urethrotome of Otis. I give here the drawing and a summary description.

As is seen from the figure (Fig. 2), the instrument when closed consists of two flexible metallic bars (*a* and *b*) firmly joined together, and of a metallic spiral (*c*) which represents a pierced sound, all united at the extremity in a truncated conical point, also perforated (*d*). In the handle there is an eyelet (*e*) for the guidance of the instrument, and a screw (*f*) serving to separate the two bars, raising the inner one by straightening out the cross bars (*g*), which vary the distance of the bars according as desired.

Having passed the stricture with a whalebone filiform, such as may pass through the pierced extremity of the instrument, and preferably ending in a little metallic olive as in the guides of Durante's œsophagotome, over this (Fig. 2) the closed instrument is introduced, and arriving at the stricture is pressed gently but surely across it, since in this way it only acts as a guided conical sound. When the strictured point has been passed, the screw in the handle is turned and the bars are separated (Fig. 3), more or less, according as it is desired; it being observed that great force is not necessary, and that we may content ourselves with a slight divulsion, not dangerous, so that immediately, or in the following days, we may pass it with sounds of increased caliber. But this limitation is almost inherent in the instrument itself, since by its very curve and the direction in which the transverse bars rise, if the dilatation is exaggerated or if the resistance at the stenosed point is great, the separation of the bars will not take place, and the screw movement is counterbalanced by the increase of the curve of the whole instrument.

We may convince ourselves of this by forcibly pressing the extremity of the instrument while we turn the screw in the handle.

In the case in which I used this divulsor the manipulation was performed easily without any kind of inconvenience, either immediately or later on; and only on the day after the operation the passage of food, even liquid, was more difficult, and

the patient complained of a slight pain in the epigastrium; but after the second day swallowing was easy and the passage of the sounds possible, while, as I have said, it was before very difficult, and, above all, I found it easy gradually to increase the caliber of the sounds until we reached a sufficiently large dilatation, which was maintained, the sounds passing from time to time until the death of the patient two months after the operation, happening almost unexpectedly and from pulmonary lesion.

Another important feature to be emphasized in narrating this case of mine was the nature of the stricture. The sufferer, forty-two years of age, had been a hard drinker (especially of spirits), smoker, and an inveterate tobacco chewer.

There was never an ingestion of acids or hot liquids; there was no syphilis; there was, on the other hand, pulmonary tuberculosis, and the year before he had suffered an operation of gastro-enterostomy for pyloric stenosis.

Given the pulmonary tuberculosis, a specific stenosis might have been imagined. But the hardness of the stricture, the complete absence of any bleeding under repeated manipulation and attempts at soundings, the fact that the obstacle to the passage of liquids did not increase, and that the attempts could be continued for weeks, also excluding the idea of neoplasm, seemed to me convincing reasons to the contrary.

I may mention that Debove communicated to the Society of the Hospitals of Paris (August 12, 1887) (De l'ulcère simple de l'œsophage et de rétrecissement consecutif de cet organe. Gaz. litt. de med. et chir., 2 Sept., 1887), two cases in which he admitted stricture of the œsophagus following on simple ulcers altogether resembling those of the pylorus.

Basing his opinion on incomplete anatomical observations of Quincke, he attributed these strictures to simple ulcers. The first was dilated and cured; the second patient, on the other hand, died, and Debove says that the autopsy confirmed the opinion that there had been ulcer of the œsophagus analogous to gastric ulcers.

It is to be noted that Debove's patient had formerly had

hæmatemesis, and died from the perforation of a typically trophical gastric ulcer. On the œsophagus, five centimetres from the cardiac, he found a circular scar one-half centimetre deep, with some fibrous irradiations towards the upper and lower portions of the mucosa. The forefinger could pass over it easily. (The patient was catheterized daily for the last three years.) Above the strictured point the œsophagus was cleanly dilatated.

In the case under my observation, the absence of determining causes of stricture or ulcers of the œsophagus, the decisions I came to, as above set forth, as to the neoplastic or specific nature of the affection, the low position of the stenosis, the contemporaneous existence of pyloric stenosis, all made me think that here I had to do with a similar example to that of Debove.

Case.—G. V., of Camerino, clerk, forty-two years old, entered the Hospital of San Giacomo, February 21, 1904, and was placed in my section at No. 22 (Ward Genza). (Descriptive No. 515.)

Nothing important as to heredity. He had been an obstinate drinker, smoker, and tobacco-chewer. He asserted he had only once had blennorrhagia. In the spring of 1903 he had violent pains in the gastric region, with fever, from which he got better under a treatment of dieting and medicaments. But in June the former troubles came on again, and just after swallowing food he used to be taken with violent efforts to vomit, which ended in ejection of the food, unless in liquid form; he had, besides, pain along the œsophagus during deglutition, also in the stomach immediately after his meals.

These symptoms grew more severe, the pain went on increasing, and became almost permanent.

With a diet rigorously liquid, alkalies and bismuth, he seemed to get better; but at any attempt to introduce any food not liquid the same troubles recommenced, in especial the efforts to vomit, the pain in the gastric region and pain also at a point in the back. He stated further that he had before this time and before taking any medicine (bismuth, for example) pitch-black excrement; on the other hand there had never been hæmatemesis.

He therefore entered the Hospital of San Giacomo in August, 1903, and was declared to be suffering from dilatation of the stomach. It was at a distance of two fingers' breadth above the navel, and there was pain upon pressure of the epigastric angle.

He was operated on September 1. He was found to have the stomach enlarged, pyloric stenosis, no neoplasma. He was operated by Doyen's gastro-enterostomia process.

He left the hospital cured October 11, 1903. He remained fairly well until December, always, however, observing a careful diet, when suddenly, and without dietetic disorder, he began again to have vomitings of his food, and not to be able to swallow more than a mouthful of liquid at a time through an impediment above the stomach that the patient localized in the epigastrium. He said if he swallowed four or five mouthfuls of liquid together he felt full up to the throat, almost suffocated, and, finally, was obliged to disgorge all. If, on the other hand, he drank small draughts at intervals, he felt the liquid gradually descend into the stomach, and then he had no further difficulty digesting perfectly. His motion was irregular and constipated.

When I tried to introduce an ordinary gastric sound it entered easily for some distance, and at a given point stopped at an insurmountable obstacle, about forty centimetres from the dental arch. With conical cylindrical olive-pointed œsophageal sounds I did not succeed in passing, nor yet with the smaller ones; only once I managed the passage with a sound of five millimetres caliber, and that only after repeated efforts; but in the same sitting, after the first had been removed, I could not proceed with sounds of increased caliber, nor in the following days was I able to reintroduce the same sound.

The passage of liquids was, however, possible, and the patient could nourish himself, swallowing by mouthfuls milk and broth. So I suspended the gastrostomy I had intended, and also any attempt at retrograde catheterism, and I constructed my instrument.

When I had it, for several days I could not use it, since I could not succeed in passing the stricture even with a whalebone olive-pointed filiform of two millimetres.

At last on April 4 I succeeded in introducing the filiform, and over this I soon brought the instrument, which with graduated efforts I succeeded in bringing past the strictured point;

afterwards I turned the screw to widen the arms and then withdrew all.

In the following days I easily introduced sounds of five millimetres and six millimetres, and in the sequel we succeeded in easily passing sounds of one centimetre and more, while the patient could swallow porridge (minestra) and minced meat. At the end of May the lung trouble from which the patient had suffered, grew worse. He died of this on June 4. At this time the œsophageal stricture had been sufficiently dilated, and the passage of the sounds was only made every three or four days.

We could not make the autopsy, through objections on the part of the family.

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PAROTITIS FOLLOWING INJURY OR DISEASE OF THE ABDOMINAL AND PELVIC VISCERA.[1]

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AMONG the many complications which may be met with after operations on or diseases of the abdominal and pelvic viscera, one of the rarest, and at the same time one of the most interesting, is parotitis.

No distinctive name has as yet been given to this variety of parotitis. Secondary parotitis is too wide, as there are other varieties of secondary parotitis than the one now under consideration; postoperative parotitis is too narrow, as a fair number of instances have arisen in the course of disease of the abdominopelvic viscera without operation. The title of this paper, though it is accurate and embraces all the cases, is lengthy and cumbrous as a name, so, as the condition practically only follows lesions of the contents or of the wall of the cœlom, this form of parotitis will, for the sake of brevity, be referred to in this paper as cœliac parotitis.

The reports of many of these cases are very imperfect, the occurrence of parotitis being often merely mentioned as an incident in the progress of the case, with no details as to date of onset, side affected, or occurrence of suppuration, etc.; but a sufficient number is reported with enough detail to enable conclusions to be drawn.

The primary lesions which give rise to cœliac parotitis cover a large field, and vary greatly in their nature and severity. In 1886, Stephen Paget[1] published abstracts of some sixty cases which he had collected, and in the following year published a statistical paper[2] based on reports of 101 cases. These he groups according to their cause, as follows:

[1] Read before the Devon and Exeter Medico-Chirurgical Society, April 15, 1904.

10 cases arose after disease or injury of the urinary tract.

18 cases arose after disease or injury of the alimentary canal.

23 cases arose after disease or injury of the abdominal wall, peritoneum, or pelvic cellular tissue.

50 cases arose after disease or injury or temporary derangements of the generative organs.

It will be seen that lesions of the generative organs account for half the cases, and of this proportion over twenty cases—roughly 25 per cent. of the total number—occurred after removal of cystic ovaries. Nearly fifty more cases have been recorded since 1887, and when these are added to Paget's 101 cases, the proportion of cases arising after ovariotomy is somewhat lessened, which is only what might be expected from the greatly increased scope of abdominal surgery in the last fifteen years; but ovarian cysts still easily head the list of the causes of cœliac parotitis. Perforated gastric ulcer seems to come next in relative frequency, while the other cases have arisen after most of the ordinary abdominal operations, more rarely after disease of the various viscera without operation,—appendicitis, puerperal fever, intestinal obstruction, removal of Fallopian tubes, gastric ulcer (without perforation), and acute gastritis, to name but a few of the conditions; while a few cases have arisen after such trivial causes as the passage of a catheter, the insertion of a pessary, a blow on the testicle, menstrual disturbances, and the menopause. It is to this last group of trivial causes that Paget[2] refers when he speaks of "temporary derangement of the generative organs."

The time of appearance of this parotitis varies considerably: it may come on as soon as the day following an operation, or as long as two or more weeks after. The greatest interval was in a case following removal of a huge hydatid of liver, the parotitis appearing fifty-four days after the operation and twenty-three days after the bladder had first been washed out for cystitis.[3] No average time can be fixed for its appearance, but after operations on the pelvic or abdominal viscera the majority of cases have arisen in the first week; while those

following delivery or abortion usually appear in the second week.

In about one-third of the cases both parotid glands have been involved, the second following the first at an interval of about twenty-four to forty-eight hours, as in mumps. The bilateral cases are rather more frequent after ovariotomy than after other conditions (36 per cent. against 25 per cent.). When only one gland is affected, the right one suffers more frequently than the left; but there seems to be no relationship between the side operated on and the side affected by parotitis.

The parotitis may end by resolution in a few days, or may go on to suppuration, the latter being rather the more frequent; and Paget [2] points out that suppuration always takes place when the patient is in a septic state. On the other hand, suppuration in the gland sometimes occurs when the seat of operation remains free from any signs of sepsis. Although suppuration is the more frequent ending, it is evident from what has just been said that it is not an essential feature of the condition, but is an accident due to the additional infection of the already inflamed gland; in most cases by a septic state of the blood, in others by the entrance of pyogenic organisms from the mouth *viâ* Stenson's duct.

As a rule, cœliac parotitis does not cause much constitutional disturbance: there is usually but slight rise of temperature, and high temperature or rigors due to the parotitis *per se* are quite exceptional; but considerable pain is common, and the appearance of a parotid bubo a few days after a patient has undergone a severe operation must always be a rather serious complication from its interference with feeding and from the effects of the pain, and in this indirect fashion may be sufficient to turn the balance against the patient. In Paget's [2] series, death occurred in thirty-seven cases; but he is careful to point out that in every instance this was due to the primary disease or operation and not to the parotitis. In one of his cases, however (No. 32 in the series),[1] it appears very probable, from the short account given, that the parotitis was directly responsible for the death of the patient, as the complication appeared six days after

an ovariotomy, suppuration occurred, and, spreading beyond the limits of the gland, set up a diffuse cellulitis of the neck. Up to the time of appearance of the parotitis the patient had had no rise of temperature and was apparently doing well. In another case, reported by the present writer,[4] a right-sided parotitis occurred four days after an appendectomy: the inflammation was of a gangrenous type, and was undoubtedly the direct cause of death, as the patient's abdominal condition was perfectly satisfactory.

It will be evident that a study of cœliac parotitis is rendered difficult by the very conditions under which it arises, for the primary condition is usually a serious one, and overshadows and masks symptoms which may be due to the parotitis *per se*. The cases in which the parotitis follows "temporary derangement of the generative organs," though few in number, are therefore of great value, inasmuch as in these the symptoms due to the primary condition are practically nil, the parotitis stands out as the dominant feature, and can be studied with more exactness. A case of this nature has been recently recorded by Dalché,[5] and will be very briefly described here, before proceeding to discuss the probable cause of this parotitis.

The patient, a woman of forty-four, had reached the menopause some months previously. For a year she had been subject to attacks of double parotitis, recurring usually every month, sometimes every six or eight weeks, rarely twice in a month. One parotid would quickly enlarge, and the other follow suit within twenty-four hours. The skin over the swellings was tense, red, and shiny; there was great pain but little or no fever. After two or three days the swellings would disappear as quickly as they came. The tongue was but slightly coated, there was no dryness of the mouth, and the teeth were in good condition.

The main interest of cœliac parotitis lies in its cause, and various theories have been put forward, none of which, however, give a satisfactory explanation of all the cases. The three chief are (1) the pyæmic theory, (2) the oral sepsis theory, and (3) the "reflex" theory.

(1) The first theory is that the parotitis is due to pyæmic infection of the gland,—in the old surgical sense of the term, be it noted, not in the modern and wider sense. This is most

difficult to accept. Five of Paget's cases certainly arose in the course of puerperal pyæmia, but, excluding these, there are considerably over 100 cases in which this parotitis was the only secondary symptom. Paget [2] points out that in true surgical pyæmia a secondary abscess in the parotid is quite an exceptional occurrence; and it is impossible to believe that all these instances of parotitis were really cases of pyæmia in which the parotitis was the sole secondary symptom. Then in nearly half the cases the gland does not suppurate; and there are also a large number in which the operation area remains free from all sign of sepsis. Further, if pyæmic infection be the real cause, parotitis should surely be found arising occasionally as a solitary event after operations on other parts of the body; but such a case has yet to be recorded.

(2) The second theory is that cœliac parotitis is caused by infection of the gland by micro-organisms from the mouth *via* Stenson's duct, and at first sight this seems the obvious explanation. The mouth is always teeming with microbes; a study of the recorded cases makes it evident that in the majority, the patients, from the nature of the primary condition, must, before the onset of the parotitis, have had thickly furred tongues and coated buccal mucosa, with consequent increase in the number of organisms present; while in some cases an additional source of sepsis in the form of carious teeth has been noted. It is tempting to assume that in oral sepsis lies the cause of this parotitis, but a little consideration will show that it can hardly be the sole cause. In the first place, there are the cases following "temporary derangement of the generative organs," in which oral sepsis, or, at any rate, an increase in the oral septicity, can be practically excluded. Against the other cases being due to oral sepsis it may be urged that oral sepsis from carious teeth is only too common, but parotitis is never met with arising from this cause alone; and that in an immense number of cases of acute disease the patients have foul, dry tongues and mouths,—conditions which should be so favorable to the development of parotitis that, if buccal infection be the *causa causans,* parotitis could hardly fail to be a

fairly common occurrence in nearly all acute illnesses; indeed, one would expect it to be almost as common as acute otitis media in scarlet fever. In the typical case described above, such fleeting and repeated attacks of inflammation could scarcely, as Dalché [5] points out, be due solely to the action of buccal organisms. But one of the strongest arguments against this theory is the fact that the submaxillary and sublingual salivary glands are practically never affected, whereas on this theory one would expect to find them involved quite as frequently as the parotids. But, though oral sepsis cannot be the exciting cause, there is little doubt that it is the source of a pyogenic secondary infection of the gland in some of the suppurative cases. Organisms, no doubt, frequently make their way from the mouth to the gland, but, as is the case with other organs communicating by means of a duct with a mucous surface or with the exterior, the cells, when healthy, are able to deal with these intruders; but when their vitality is lowered by previous injury or inflammation, their bactericidal properties are impaired, a *locus minoris resistentiæ* is created, and the organisms are able to gain a hold and produce their specific effect.

(3) The third theory—that cœliac parotitis is due to reflex nervous action—that it is, in fact, a "sympathetic" inflammation, has received considerable support from many writers on the subject. The argument in its favor may be briefly stated thus: the "sympathy" between the parotid glands and the genital organs is shown by the frequent occurrence of orchitis (or more rarely of oöphoritis or mastitis) as a complication of mumps; the fact that parotitis occurs after ovariotomy shows that this sympathetic current may be reversed; therefore secondary parotitis must be a reflex or "sympathetic" phenomenon.

Like the other two theories discussed, this one will not bear critical examination. In the first place, what evidence is there of a sympathetic nervous connection between the parotids and the generative organs? Of experimental proof there is absolutely none, so far as the writer can discover. The clinical

evidence rests chiefly on the occurrence of orchitis in mumps, though the salivation of pregnancy and the enlargement of the salivary glands met with in some of the lower animals during the breeding season are also adduced in support of the theory. One writer [6] on the subject says that the fact that orchitis occurs as often as once in every sixty cases of mumps is proof beyond doubt of a nerve connection between the parotids and the generative organs; another [7] says that " connection between organs as remote as those of the neck and those of the abdomen and pelvis can only exist through the medium of the sympathetic nervous system." One can only conclude that they have never heard of micro-organisms; and wonder if, in acute rheumatism, they regard the involvement of structures as remote from one another as the heart and the ankle- or knee-joints, as proof beyond doubt of a sympathetic nervous connection between them. The orchitis, as well as the other and rarer complications of mumps (meningitis, endocarditis, arthritis, etc.), will surely be more generally regarded as due to the action of the specific micro-organism (or its toxins) which is the cause of mumps, and whose seat of election is the parotid glands. It seems, therefore, that, in the absence of any evidence of a nervous tie between the organs, the reflex theory of the cause of cœliac parotitis breaks down, at any rate as far as the pelvic cases are concerned. In the case of the alimentary canal, however, there is of course a nervous tie with the salivary glands, and the well-known fact that the secretion of saliva may be reflexly influenced by disease or injury of the digestive tract is adduced as evidence in support of this theory. But the undoubted fact that nervous impulses can control secretion is no proof that they can cause inflammation; indeed, all our knowledge of inflammation is opposed to this. It may, however, be urged that reflex action, by temporarily inhibiting the secretion of saliva and so rendering the mouth dry, merely opens a way for the entrance of micro-organisms from the mouth along Stenson's duct; but this is open to the same objections that can be brought against the oral sepsis theory,—that in an enormous number of cases of illness in which there is fever, the same

conditions are present, namely, deficient salivary secretion plus a septic state of mouth; but the buccal organisms signally fail to take advantage of the opportunities thus offered them for invading the parotid. Besides, it should be borne in mind that stimuli reaching the gland through the sympathetic cause constriction of the blood-vessels, and so prevent that congestion which is so favorable a predisposing cause to microbic invasion. Again, stimuli reaching the salivary glands from the alimentary canal in all probability affect all three pairs of glands, and we should therefore expect to find the submaxillary and sublingual glands involved fairly often; but, as a matter of fact, the number of cases in which they have been affected is so small as to be negligible. But more important than all is the fact that a secondary parotitis, similar in all respects to the cœliac variety, is met with in certain of the acute specific fevers, in which neither abdominal nor pelvic viscera are affected, and in which, therefore, this reflex action can be excluded.

If neither pyæmia, oral sepsis, nor reflex action be the cause of cœliac parotitis, to what must we look for the explanation of this interesting condition? Dalché,[5] in commenting on his case of climacteric parotitis mentioned above, compares the parotitis with the congestive disturbances of other organs sometimes met with at the menopause, or in association with menstrual disturbances, and, after a cautious discussion of the various theories, none of which he appears to accept, concludes his paper with these words: "One thinks more readily that it arose primarily from vasomotor disturbances, aroused perhaps by a genital autointoxication." The writer believes that this suggestion gives the clue to the cause of all the cases.

Besides the action of the nervous system, a tie between organs remote from one another may be brought about by chemical agency, and in following up Dalché's suggestion it is necessary to see, firstly, if parotitis can be caused by the action of toxic substances; and, secondly, if in cases of cœliac parotitis there is any evidence of toxic substances being present in the blood. It may be said at once that there is evidence in favor of both these points. In the first place, in mumps (to which many

cases of cœliac parotitis have a strong resemblance) we have a parotitis due to the action of toxic material of microbic origin. Then there is the secondary parotitis met with in cases of chronic poisoning by lead, mercury, copper, and iodine; and that substances like this can cause a very acute inflammation is shown by a case of parotitis due to poisoning by iodide of potassium mentioned by Comby,[8] in which the swelling of the glands reached a maximum in a few minutes. Lastly, there is the variety of secondary parotitis met with as a complication of certain acute specific fevers, namely, in enteric fever, cholera, typhus, small-pox, pneumonia, cerebrospinal meningitis, and (exceedingly rarely) in scarlet fever. In the first two the alimentary canal is, of course, involved, but in the others neither abdominal nor pelvic viscera are affected, and therefore the reflex theory cannot be invoked. Now it is in some of these diseases that secondary parotitis is most frequently met with: in enteric fever it occurs in 2 per cent. of the cases; in cerebrospinal meningitis it is said to be fairly common, and in typhus (a toxæmic and septicæmic disease *par excellence*) it reaches its greatest frequency, about 5 per cent.; while after abdominal operations its incidence, at the most liberal estimate, cannot be 1 per cent.; and if every case of abdominal and pelvic disease be added, its frequency, of course, is enormously decreased. Now the one condition which characterizes all these widely different specific diseases is that in all of them toxic substances are present in the blood; and the writer submits that it is these toxic substances which are the cause of the parotitis, which appears, as a rule, about the height of the disease, or, in other words, when the toxic material is present in greatest abundance. It will, of course, be objected that the parotitis is due, not to the toxins in the blood, but to the septic state of the mouth which is so frequently present; but that this is not really the case is shown by the fact that parotitis is not met with in other acute infectious diseases, such as acute rheumatism, yellow fever, and diphtheria, in all of which, and especially in the last, the mouth is in a septic state; nor, as already pointed out, is it met with in the numberless other cases of acute disease

in which an equally foul condition of the mouth is found. Further, in those infectious diseases in which parotitis occurs, its different frequency in the various diseases can hardly be explained by differences in oral septicity, while it can easily be explained on the assumption that the parotid is more readily affected by the poisons of some of these diseases than of others; and it is noteworthy that in the two diseases which are frequently marked by extremely septic mouth, namely, scarlet fever and diphtheria, parotitis is respectively extremely seldom and never found. It may therefore be taken that the variety of parotitis met with as a complication of many of the acute specific fevers is due to the action on the gland of toxic materials present in the blood; and it will also be seen that the parotid gland is an organ which is very susceptible to the action of a number of different poisons.

As regards the second point, whether there is any evidence of toxic material being present in the blood in cases of cœliac parotitis, it is necessary to examine the records of the cases. These show that over 20 per cent. arose in connection with cystic disease of the ovaries. Now the descriptions given in the older works on gynæcology of the constitutional effects of long-standing cases of ovarian cysts, make it quite clear that toxic materials are formed by and absorbed from them in abundance. Nearly as large a proportion of the cases has occurred in connection with other forms of ovarian disease. Now we know that many of our organs manufacture internal secretions which are capable of exerting considerable influence on other parts of the body, and that these secretions are modified by unhealthy conditions of the organs producing them. That the ovaries, and also the testicles, normally produce such substances is beyond dispute; one has only to study the results of their removal when functionally active to see this; while possibly the swelling of the thyroid often met with at the menstrual periods, and the many congestive disturbances which may occur at the menopause, are instances of the action of the ovarian secretion; and Paget[1] mentions a significant case in which parotitis occurred at several successive months in place

of the menstrual period. It seems quite possible that the secretion of these genital glands, modified by injury or disease, and of the ovarian cysts, may be irritating to the parotids, and may cause them to become inflamed. Turning to the alimentary cases, it is noticeable that in half of them peritonitis was present, and we know too well that in this condition there is free absorption of toxic material; while in some cases the bacillus coli may possibly be present in the blood. In the alimentary cases without peritonitis there were, in practically all, such conditions as gastric ulcer, intestinal obstruction or malignant growth in the bowel, in all of which there would consequently have been derangement of digestion and usually increased absorption of intestinal contents. A perusal of the effects of the absorption of intestinal contents given by Bouchard [9] in his work on "Autointoxication" makes it clear that no stretch of imagination is needed to believe that this cause may also be responsible for the production of parotitis; and bearing on this, a case seen by the writer a few years ago is very suggestive, as the parotitis arose in a patient suffering from ptomain poisoning from tainted meat, and in whom local symptoms were very slight, but the constitutional effects of the poison were marked. In the uterine cases it is most probable that the interference with the uterus has a reflex effect upon the ovaries, and so causes a modification of their secretion. This may also be the explanation of the cases arising from puerperal sepsis, or the infection in these cases may have been due to the colon bacillus. The latter view seems to be favored by the fact that, as pointed out above, parotitis does not appear, as a rule, until the second week, which may be due to the septic process in these cases not becoming established so quickly as when it occurs after abdominal section. As to the small remaining group of cases arising after operations on the male bladder, there was cystitis or residual urine in all those of which details are given: the contents of the bladder would in these cases form the source of the toxic material, and probably the slight damage to the mucous membrane caused by the catheter or sound opened up

a path for absorption. This is rather borne out by a case lately related to the writer by a friend, in which parotitis followed a suprapubic prostatectomy.

The writer ventures to hope that enough has been said to show that in all the recorded cases of cœliac parotitis there is actual or presumptive evidence of the presence in the blood of toxic materials: there is, of course, no proof that any of these substances are the cause of the parotitis, but, taking the facts in conjunction with what has been shown of the susceptibility of the parotid gland to various other chemical substances, it is surely justifiable to regard this explanation of the cause of cœliac parotitis as correct.

A few possible objections may now be dealt with. The first is that, if cœliac parotitis be due to toxins, it should always be bilateral, since both glands are equally exposed to the action of the toxins; but this objection has no weight, for in other conditions in which bilateral organs are equally exposed to certain influences, it is quite common for only one to be affected. For instance, in mumps, both testicles are equally exposed to infection, but it is usual for only one to be attacked. Again, in the parotitis due to chronic poisoning by mercury, lead, etc., though it would appear that both glands are always involved, there may be an interval of several weeks between the involvement of the two sides; and in these cases it must be remembered that the action of the poison is continued for a considerable time, while in cœliac parotitis the toxic material has usually but a few days in which to act. Possibly a larger dose or more prolonged action is necessary to affect both sides, and this is rather borne out by the fact that double cœliac parotitis occurs most often in connection with ovarian disease, in which absorption has been going on for a longer period than in most of the other cases.

The next objection is that on this autointoxication theory the parotitis should be a frequent occurrence, but its rarity is more difficult to explain on the other theories discussed. On the oral sepsis theory, one would expect it to be fairly common; on the reflex theory it should be the most frequent complica-

tion of abdominal and pelvic diseases; in fact, as Dalché [5] pertinently remarks, "it is strange that these (nerve) connections so seldom exert their influence." The objection is easily overcome by the autointoxication theory. In the first place, one would not expect the parotitis to arise after a simple abdominal section with but little handling of bowel, no soiling of the peritoneum, and no subsequent peritonitis; and so far no case has been reported as following such an operation. In cases in which peritonitis is present, or in which there is disease or injury of secreting organs, but in which parotitis does not occur, it is quite justifiable to assume that the particular toxic materials are not formed or absorbed in sufficient quantity to affect the parotid; or that they are excreted or neutralized before they can affect the gland. Only a few cases of chronic lead-poisoning develop parotitis. No one doubts that post-diphtheritic paralysis is due to the toxins of the diphtheria bacillus, because it only occurs in a small percentage of the cases.

The last objection is best expressed by the query, Why should these toxic substances pick out the parotid glands of all organs and affect them only? To this it can only be answered that the cells of certain organs will react to certain poisons, while the cells of other organs remain unaffected. It is not considered necessary to explain why the toxins of scarlet fever should have such a marked effect upon the kidneys; or, to take a more particular instance, why atropine should pick out and paralyze the endings of the third nerve in the iris.

To sum up:

1. It appears most probable that cœliac parotitis is due to the action on the parotid glands of toxic substances absorbed into the blood and derived from (*a*) the secretions of certain organs modified by injury or disease; (*b*) toxins of microbic origin (*e.g.*, bacillus coli) absorbed either from the alimentary canal, peritoneal cavity, or bladder; (*c*) products of deranged digestion.

2. In any given case of injury or disease of the abdominal or pelvic viscera, the occurrence or not of parotitis will there-

fore depend on the presence and the absorption in sufficient quantity of some of these various toxic agents.

3. Suppuration is not an essential feature of the condition, but is due to the fact that the parotid gland, when inflamed by the action of these toxic agents, forms a *locus minoris resistentiæ,* and becomes secondarily infected by pyogenic organisms reaching it (*a*) by the blood-stream; (*b*) by Stenson's duct.

In conclusion, while this theory, like the others discussed, is not capable of proof at the present time, the writer ventures to submit that it is one which affords an explanation of all the cases, and which is in accordance with our present knowledge of pathology.

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DUODENAL ULCER.

A CLINICAL REVIEW OF FIFTY-EIGHT OPERATED CASES, WITH SOME REMARKS ON GASTROJEJUNOSTOMY.

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DUODENAL ulcer has been considered a rare malady, and surgically has not received the attention its importance merits. Weir, in a masterly paper before the American Surgical Association, in May, 1900, analyzed the cases reported in literature, and with observations drawn from his own experience placed the subject on a sound foundation. Interest has been still further quickened by a number of workers, notably, Murphy and Brunner.

It has been stated that nearly all duodenal ulcers are secondary to gastric ulcers, and that the two are usually combined in the one case. This has not been entirely borne out by our experience, at least the gastric ulcer, if present, has not been of the same grade and character as the duodenal. It is of course possible that a round or fissure ulcer of the stomach might have existed without recognition from the exterior of the stomach wall.

Based on the same examination in ten out of our fifty-eight cases of duodenal ulcers, there was a separate, distinct ulcer found upon the gastric wall. In eighteen cases the pylorus was involved by a lateral extension of the duodenal ulcer, making twenty-eight out of fifty-eight, or about 50 per cent. In 100 cases of chronic gastric and duodenal ulcer recently reported by Moynihan (ANNALS OF SURGERY, May, 1904), twenty-two involved the duodenum, in nine the lesion was confined to the duodenum, and in thirteen, separate and distinct ulcer existed upon both gastric and duodenal walls. Up to two years ago, 11 per cent. of the gastric and duodenal ulcers which came under our care involved the duodenum, 89 per cent. the

stomach. During the past year, with more careful observation, we find 27 per cent. duodenal alone, or combined with gastric ulcer. This includes a numerous group of duodenal ulcers which extend up to and involve the pyloric ring.

We have seen a number of pyloric ulcers due to lateral extension and involvement of a gastric ulcer, and in several of these the duodenum was attacked on one margin. In others the gastric wall was involved in a duodenal ulcer, the classification of gastric or duodenal being based upon the extent of the involvement. In all of the cases of duodenal ulcer with five exceptions, the ulcerated area was easily identified as a thick, opaque spot, puckered in appearance, and usually covered by peritoneal adhesions, closely resembling the large, irregular gastric ulcer of Robson, and likewise it has been more frequent in adult males. Seymour Taylor, in this variety of gastric ulcer, found seventy-two males to twenty-eight females. In the series of fifty-eight duodenal ulcers herein reported, forty-three were in males, fifteen were in females. In two of the acute perforating cases the ulcer was clean, clear cut, and set in normal tissues; in four the perforation was through a thickened area. In the chronic cases a few completely surrounded the duodenum, in others the outlines were irregular and of various sizes and shapes, and in the smallest at least one centimetre in diameter. Most of them involved a considerable extent of intestinal wall. The five cases without any appreciable thickening are of great interest; of the two acute perforations just referred to, one gave a history of four years' chronic trouble; the second of but two weeks; no other ulceration of either stomach or duodenum could be detected. In the third there was chronic hæmorrhage with acute exacerbation; the fourth case, in which gastro-enterostomy was done, died six months later from another cause, and post-mortem did not disclose macroscopic evidence, at site of previous slight thickening, of any defect in the mucous membrane; the fifth case was buried in adhesions, evidently there had been a minute perforation, which, however, could not be identified. This would seem to indicate that typical round ulcer of many years' standing

may exist without involvement of the outer coats, and therefore give little or no external evidence of disease, just as happens in the stomach. It is probable, however, that most duodenal ulcers are of the cicatricial type, and in our series there has been a relatively greater tendency to perforate than in gastric ulcer. This is shown by the peritoneal adhesions which are so often found, and by the frequency of what may be called chronic perforation, protected by a mass of adhesions to the liver, gall-bladder, or gastrohepatic omentum. These structures often form a plaster over the perforation and protect against extravasation of bowel contents. Such chronic perforations were found in ten of the fifty-eight cases. In but two patients did there appear to be more than one ulcer of the duodenum, and in one of these there was some question as to whether there was not some connection between. In two cases of supposed gall-bladder disease, which we had opened and drained on account of adhesions thought to be due to cholecystitis without stones, no relief followed, and reoperation became necessary. At this time more careful investigation revealed duodenal ulcer.

In a previous paper (ANNALS OF SURGERY, July, 1903), the writer referred to four cases of periduodenitis of unknown origin, operated upon for supposed gall-bladder disease, and in which the condition of the gall-blader did not bear out the presumption. One of these cases has since been reoperated and duodenal ulcer found.

Considering the known errors and the possibilities springing from a predetermined gastro-enterostomy and imperfect examination of an ulcer situated in the pyloric region, it must be evident that duodenal ulcer is a far more common condition than has been thought. The situation of the duodenum renders it especially liable to erosion from irritating gastric secretions which the thinness of its tunics enables it to resist but feebly. Its sheltered situation fortunately enables protective adhesion in many cases, while its limited capacity and freedom from obstruction beyond prevent tension. The normal condition of relatively sterile contents, especially in the class of cases under discussion, is also a favorable circumstance.

All the cases of duodenal ulcer occurred in the first two and one-half inches of the bowel, and entirely above the entrance of the common duct, and therefore in an accessible situation. These errors should be largely eliminated, and in all doubtful cases of gall-stone disease and gastric ulcer in which duodenal ulcer is possible, the first portion of the duodenum should be inspected. For this reason, we now employ a longitudinal incision one inch to the right of the median line through the rectus muscle. This enables careful examination of the duodenum, gall-bladder, stomach, and pancreas. If more space is needed, Bevan's lateral cured prolongation of the incision at either the upper or lower end or both, gives additional access to these organs. Longitudinal incisions through the body of the muscle close well, and are more reliable against hernia than when located in the median line.

The operative indications are few. The causation and continuation of duodenal ulcer depends on the irritating gastric secretions. These must be diverted by a gastro-enterostomy. If acute perforation exists, suture of the opening and cleansing of the infected area in the peritoneal cavity combined with gastro-enterostomy, if the patient's condition warrants it, best fulfils the indications. Should there be extensive peritonitis, pelvic drainage and the nearly sitting posture (exaggerated Fowler position) should be instituted for a few days following operation. For convenience, the fifty-eight operated cases are divided into five groups: 1st, Acute perforation; 2d, Hæmorrhage; 3d, Chronic ulcer with gastric complications; 4th, Chronic perforating ulcer with gall-bladder and liver complications; 5th, Chronic ulcer requiring operation for relief of pain and distress.

Group One. Acute perforation, six cases, two deaths. Acute perforating ulcer was found six times, in all but one a complication of chronic ulcer with a history of four to twenty-one years' standing. In four there was some attempt at adhesions, the acute perforation evidently occurring at a site of a partially protected area. In four of these patients there was a considerable sized opening found. In two, already referred to.

there was a clean cut perforation through what was otherwise normal bowel wall. In four suturing was easy, in two difficult and unsatisfactory, requiring gauze packing. One of these cases died from inanition from prolonged leakage, although a gastro-enterostomy was done at the same time. In the other the gauze pack was left undisturbed eleven days and rectal feeding employed for five days. The leakage was but slight and the fistula soon closed. In four the suturing held perfectly, but, unfortunately, one died from pneumonia on the tenth day. In this patient a gastro-enterostomy had also been done. The conditions were unusually favorable for an operation, which was performed within two hours of the accident, and the gastro-enterostomy was considered advisable, as it seemed certain that stenosis would follow, as it had existed previously. Superficially, this would seem to argue against gastro-enterostomy in acute perforation, but in each case the post-mortem showed the gastro-enterostomy to be perfect.

Group Two. Hæmorrhage, one case, one death. There was a single case of prolonged and repeated hæmorrhage in a chronic ulcer of three years' duration; during a two weeks' period of observation the stools showed constant evidence of blood. There was a single hæmatemesis. The ulcer was easily recognized as a little thickened patch of otherwise normal bowel wall, and was excised with pyloroplastic enlargement. The man was markedly anæmic and a poor subject for anything but a forced operation. Valuable time had been lost in attempting to build him up. Death from pneumonia occurred on the fifth day.

Group Three. Duodenal ulcer with gastric complication, twenty-eight cases, one death. Chronic ulcer with stomach complications from interference with gastric drainage was the most frequent form met with, and gastro-enterostomy was performed with recovery in each instance, excepting one in which acute obstruction of the transverse colon followed anterior gastro-enterostomy. At post-mortem a long prolapsed transverse colon was found hanging over the jejunal loop as it would

over a clothes-line. The symptoms were not acute until a few hours after death. Reoperation should have been done.

Group Four. Duodenal ulcer with gall-bladder and liver complications, eleven cases, one reoperation, no death. In this series gastro-enterostomy was performed in seven cases with successful outcome. In four cases, plastic operation was resorted to with or without excision of the ulcer. In three a modified pyloroplasty, one after the plan of Heinicke-Mikulicz with a poor result, a secondary gastro-enterostomy being required within three months, the other two after the plan of Finney and with success. In the third the duodenum, at a point two inches from the pylorus, was acutely flexed upon itself by adhesions to the liver, due to a closed adherent perforation. This made it possible to do a plastic operation upon the first portion of the duodenum without disturbing the adhesion.

Group Five. Thirteen cases, no death. In this small series only were there symptoms calling for operation which did not involve the stomach or gall-bladder, and still further emphasizes the fact that it is usually the complication which hastened operation. In practically all of these cases adhesions marked previous attacks of regional peritonitis. Gastro-enterostomy was performed in each with good results.

To recapitulate, there were fifty-nine operations in fifty-eight cases. Of these seven were for acute conditions developing, with one exception, upon chronic ulcer with three deaths. Fifty-one operations for chronic conditions gave one death. At the present time posterior gastro-enterostomy would appear to be the operation of choice in the chronic cases, but the last word has not yet been said. The time elapsed since operation in the majority of the cases herein reported suggests the possibility of further sequelæ, particularly in those cases in which there is no obstruction, and in which experience has taught us that at least partial closure of the gastro-enterostomy opening may take place. It is pretty certain that even with a large gastro-enterostomy the food will pass out by preference through an unobstructed pylorus by muscular action, the apparent grav-

ity advantage of a low-point gastro-enterostomy being equalized by intra-abdominal tension. Gastro-enterostomy performed for gastric ulcer is open to the same objection if there be no stenosis. For this reason, when the ulcer does not cause at least partial obstruction, it may be necessary to artificially block the pyloric outlet.

An occasional complication following gastro-enterostomy is bile regurgitation into the stomach. Acute vicious circle will seldom be seen if the opening be made at the bottom of the gastric cavity. We had but one case in 316 gastrojejunostomies (excluding our first fourteen cases), and that one in a patient eighty years old. Chronic bile regurgitation is a more frequent condition, beginning, as Ochsner points out, within three months, if at all, although it may be a year or more before it gets troublesome.

Carle and Fantino have shown that a little bile is to be found in the stomach at times in nearly all cases after gastrojejunostomy, and state that it does no harm. We have had a number of patients complain bitterly of the distress occasioned. As a rule, the food passes out quickly, but there will be attacks of biliary regurgitation at intervals of days or weeks. We have observed this phenomenon after the various methods of operation, and have been compelled to reoperate a number of times to check the disturbance. If the patient is in good general condition, we now perform a posterior suture gastro-enterostomy with a nine- or ten-inch loop, after the clamp method introduced into this country by Moynihan (*Transactions of American Surgical Association,* 1903). Four inches below the completed gastro-enterostomy an entero-anastomosis with suture between the two limbs of the bowel is made, using the holding clamps. This adds ten minutes to the operation. A medium Murphy button is preferred by many surgeons for making the entero-anastomosis. To do this, the intestinal clamp is removed after the two posterior rows of sutures are introduced in the gastro-enterostomy and half the button passed down inside each limb through the incised jejunum to a point previously marked with the knife. The intestine is nicked, and the proper

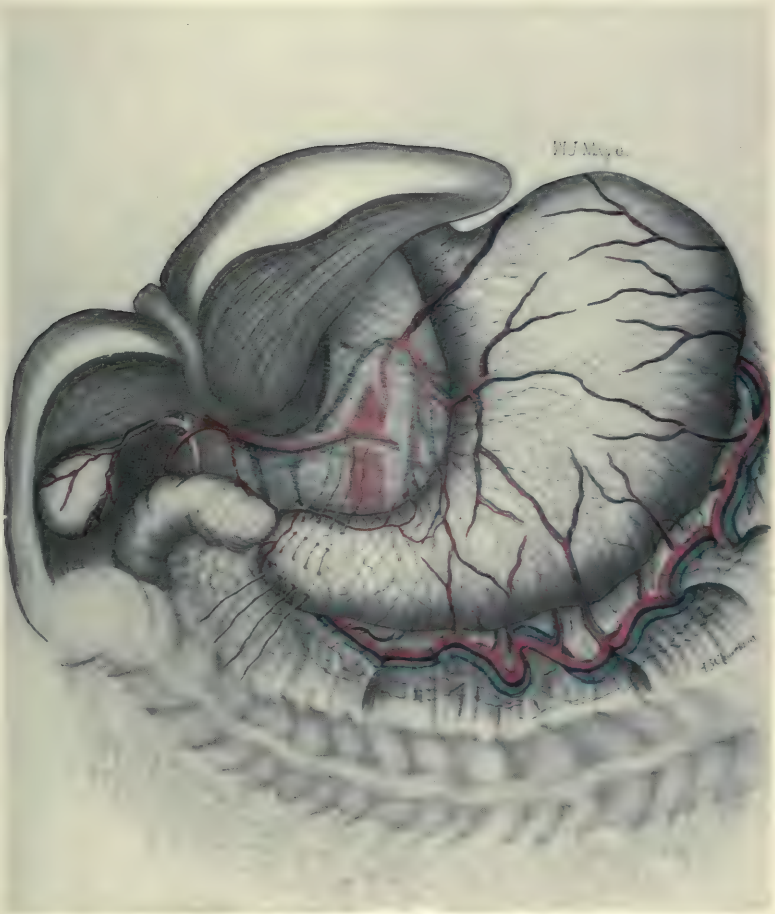


FIG. 1.—Ulcer of duodenum. Pylorus blocked by infolding method *A*. Sutures in place but not tied. Methods *B* and *C* at point marked XX.

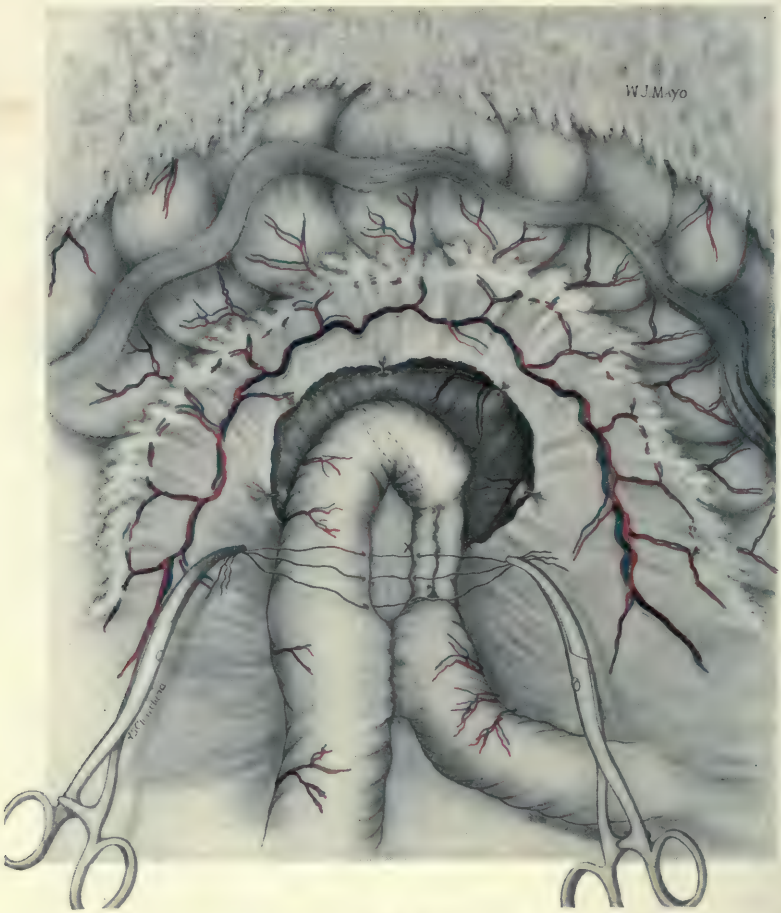


FIG. 2.—Posterior gastro-enterostomy with entero-anastomosis and infolding; sutures placed for obliterating intestinal interspace. X marks site of silver-wire constriction or complete division. Note that the drawing shows stomach and colon drawn outward and upward as in actual operation. Replacement of viscera reverses position and brings intestinal opening at the bottom of gastric cavity.

part of the button forced through and juncture made without a puckering suture (Weir). This adds about three minutes to the time.

A few mattress sutures should be placed as a protection about the button if it is employed. The only patient we lost in the last sixty-one gastro-enterostomies at St. Mary's Hospital was one in which the button union gave way suddenly on the sixth day, the patient having not a bad symptom up to that time. Secondary laparotomy was performed ten hours later, but the patient died. After completing the button entero-anastomosis, the gastro-enterostomy is finished in the usual manner, and the opened mesocolon attached to the posterior wall of the stomach in several places.

To prevent bile arising to the level of the stomach and also to cause the food to always pass out the efferent bowel, the afferent intestine between the entero-anastomosis and the gastro-enterostomy should be closed in one of three ways. Method (a). Infolding may be practised after the plan of Scott-Matolli, a continuous linen or silk suture an inch and a half in length turns the periphery of the intestine into the lumen. (Fig. 2.) Method (b). Fowler accomplishes the same result by passing a No. 20 silver wire twice about the afferent loop at point X (Fig. 2), and twisting tight enough to obstruct without injury to the circulation, the twisted ends of the wire being turned closely into the wire loop (*Transactions of American Surgical Association,* 1902). Methods (a) and (b) prolong the operation about three minutes. Method (c). We have in some secondary operations completely divided the afferent intestine at point X (Fig. 2), closing both intestinal ends by a circular suture (Doyen), making the separation absolute; operation prolonged five to eight minutes. In all cases the open space between the two limbs of the intestinal loop should be partially closed by a few sutures at its lower part to prevent a coil of bowel herniating into the opening (Fig. 2).

A comparison shows the infolding method to be the easiest, but Crile had a case in which, after a time, the infolded intestine straightened out and required another operation. The Fowler

method is evidently more certain. The Doyen operation is of course sure, but takes a little more time and adds somewhat to the gravity of the procedure. When finished, however, it has all the advantages of the " Y" operation of Roux.

Closure of the pylorus to divert all the food to the gastro-enterostomy is under consideration, and probably should be done in the large majority of cases if there is no cicatricial obstruction. The three methods already described for closure of the afferent intestine apply equally to the pylorus. The infolding method is shown in Fig. 1. The point for the application of the Fowler loop or complete division is shown by X (Fig. 1). We have either infolded or divided for the purpose of obstructing the pylorus. Ochsner has used the wire loop a number of times successfully for this purpose.

The entire time of the combined operation should not exceed thirty-five to fifty minutes, according to the method chosen, and including opening and closing the abdomen. In view of the fact that gastro-enterostomy is no longer a last resort, but an operation of choice to promote comfort and relieve disability, we must not only give a low mortality rate, but also a high percentage of permanent cures.

The cases above reported were operated upon in St. Mary's Hospital by Dr. Charles H. Mayo or the author.

TETANY, AND FOREIGN BODIES IN THE STOMACH.

TETANY CAUSED BY A MASS IN THE STOMACH, COMPOSED OF FORTY METALLIC ARTICLES, WEIGHING ONE POUND; GASTROTOMY; CURED.

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In 1869, Kuessmaul and Neumann showed that certain gastric disturbances, notably dilatation of the stomach, bore an etiological relation to tetany. Since that time a sufficient number of cases have been observed and added to the literature, to show that dilatation of the stomach, with or without pyloric obstruction, particularly when associated with abnormal retention and fermentation of food, is a cause of tetany. The cases which have supported this conclusion have also been of importance, because they have made possible a more accurate study of tetany, a complex train of symptoms which previously had been confused with tetanus, epilepsy, and other nervous phenomena.

The most acceptable theories concerning the cause of these attacks are those which attribute them to autointoxication from fermentation of stomach contents and irritation of nerve endings in an already poisoned organism. The characteristic attacks of convulsions usually follow an effort of the affected stomach to empty itself. A patient, who has suffered with chronic atony of the stomach, or dilatation from narrowing of the pylorus, and abnormal fermentation of retained food, after an effort at vomiting, or the passage of the stomach-tube, is seized with a convulsive paroxysm similar in some respects to both that of epilepsy and tetanus. A great variety of spasms have been described by different observers. The characteristic attack begins with tetanic spasms of the muscles of the forearm and hand or abdominal muscles, and is rapidly followed by

tonic contractions of the muscles of the extremities, back, and neck. Usually there is loss of consciousness. The picture is often that of epilepsy with tetanic contractions of the muscles of the limbs and back. There seems to be no typical course of the convulsive movements. A peculiar position of the hand in these attacks is described as accoucheur's hand, the metacarpophalangeal joints being flexed, the phalangeal joints extended, and the thumb adducted.

The mortality among these cases under medical treatment is reported to be 88 per cent. Of the cases operated upon, nine in all (including the case herewith reported), the mortality is 33 per cent.

Kuchein (*Berliner klin. Wochenschrift,* November 7, 1898) has reported a case due to carcinoma of the pylorus, associated with gastric dilatation. He attributed the tetany in this case to increase in the specific gravity of the blood because of the diminished absorption of fluids. This is in sympathy with the original views of Kuessmaul. Juergensen has reported a similar case (*Archiv für klin. Med.,* Vol. lx). He attributes the symptoms to autointoxication. Sievers (*Berliner klin. Wochenschrift,* August, 1898) collected reports of twenty-seven cases, three of which were associated with carcinoma of the stomach. The majority of cases of gastric tetany have been found complicated with dilatation of the stomach, following pyloric stenosis due to gastric ulcer.

Mayo Robson, who first presented the surgery of this condition, regards autointoxication from gastric fermentation as the predisposing cause; and the exciting cause he believes to be the reflex irritation caused by painful contraction of the stomach. Albu, Germain-See, and Berlizheimer have recognized the importance of mechanical gastric irritation as an etiological factor. Blazicek has reported a case in which the dilatation of the stomach was due to duodenopyloric obstruction from the pressure of a large gall-stone; and Berlizheimer has reported a case in which the same condition was due to the pressure upon the duodenum of a pancreatic cyst. I have been unable to find in the literature the report of any case due to foreign bodies in the stomach.

Cunningham, in an admirable paper on this subject in the ANNALS OF SURGERY, April, 1904, to which the reader is referred for literary references, records the seven cases which have been treated surgically, and adds to these an eighth case from his own observation. Three of these cases were reported by Mayo Robson, two by Fleiner of Heidelberg, one by Gumprecht, and one by Caird. Robson's cases were due to cicatricial stenosis of the pylorus, and were treated by pyloroplasty, the third case requiring a subsequent gastro-enterostomy. All were cured. The first of Fleiner's cases was due to sarcoma of the pylorus, and died after gastro-enterostomy. Fleiner's second case was due to inflammatory stenosis of the pylorus, and was treated by pyloroplasty. This case died ten days later. Gumprecht's case was one of cicatricial stenosis of the pylorus. It was treated by resection of the pylorus, and died of general peritonitis. Caird's case, reported by Dickson, was one of inflammatory stenosis, and was cured by gastrojejunostomy. The case reported by Cunningham, and operated upon by Watson in the Boston City Hospital, was one of cicatricial stenosis, and was cured by gastro-enterostomy.

The following case, which I operated upon in the German Hospital in Brooklyn, is of importance because the gastric tetany was caused by foreign bodies in the stomach, and was not associated with obstructive disease of the pylorus or obstructive dilatation in the ordinary sense of the term,—two conditions which had heretofore been regarded as concomitants of gastric tetany. The case is also of interest because of the number and character of the foreign bodies, and the information which it contributes to the physiology of the stomach.

J. F., male, twenty-three years old, German, married, tailor, entered the German Hospital, May 1, 1904. Healthy, well-developed man. No venereal history. No previous illnesses or family history of epilepsy. Drinks beer moderately. Married four years. Wife has one child two years old. Appetite always good. No eye symptoms.

In 1897 he began giving exhibitions swallowing metallic objects, such as nails, pins, and other small articles. He did not

swallow many of these things at one sitting, and usually found them in the bowel movements within twenty-four hours. He continued giving these exhibitions, as a means of livelihood, without mishap until August, 1900, when he fell in an unconscious state after having swallowed several nails and a watch-chain. In this attack there were severe abdominal cramps, and he was removed to St. Catherine's Hospital. No satisfactory history of this attack is obtainable. He did not remain in the hospital, but immediately resumed his occupation of giving exhibitions. In September following, he was particularly busy, swallowing as many as twenty ordinary pins, together with hair-pins and wire nails, during the course of an evening's entertainment. These things he believed all passed per anum. On one evening he swallowed eighty pins.

On December 16, 1900, after swallowing two or three watch-chains, he had another attack of unconsciousness, with convulsions, which had been preceded by violent vomiting. He was removed to St. John's Hospital, where he was retained for five weeks. During the first two weeks at the hospital he continued to pass metallic articles which he had swallowed. He complained of epigastric cramps, and during the time had a number of convulsive seizures. These he describes as following vomiting. Some of the convulsions were extremely violent. He had such a convulsion on January 2, completely turning around in bed until his head was at the foot. The following day a gastrotomy was done, and the following articles were removed: one hundred and twenty-nine ordinary pins, five hair-pins, two horse-shoe nails, twelve wire nails, two keys, and two watch-chains. He made a good recovery, and was discharged three weeks later. No satisfactory history of the tetanic seizures is obtainable. In these attacks pain was not a symptom. It is spoken of by those who saw him in convulsive attacks, because the attacks were wrongly supposed to be manifestations of pain.

He continued in fairly good health. He followed his vocation, swallowing articles passed up from the audience, and was known as the "human ostrich." He increased the number and size of articles consumed, but had no bad immediate attacks. He has suffered with frequent cramps in the calf of the right leg during the past two years. This cramp often awakened him from sound sleep, and was so severe that he would jump out of bed and walk in order to get relief. Coitus was always followed in



FIG. 1.—Showing mass of metallic materials lodged in cardiac end of stomach.

about five minutes by this cramp. During the past year he has had a choking sensation and difficulty of breathing, apparently due to spasms of the throat muscles. This choking sensation was frequent and annoying. He also had occasional cramps in the muscles of the back.

On July 16, 1903, while on a street-car, he was seized with a convulsion, and fell from the car. He was removed to the German Hospital, where he had several such attacks. He remained in the hospital only over night. On March 12, 1904, he swallowed six horse-shoe nails, eight wire nails, two padlock keys, one large brass key, and one pocket-knife, and had a tetanic attack. Several of these articles failed to appear in the stools. On April 30, 1904, he swallowed some nails, keys, and two watch-chains. While still on the stage he was seized with vomiting, spasm of the throat muscles, and fell unconscious in a tetanic attack. He was removed to the German Hospital.

In this, as in the previous attack, there was a succession of spasmodic seizures. Practically, all of the voluntary muscles were involved,—legs, arms, neck, face, and extensors of the trunk. Often the contractions of the extensor muscles of the spine and legs were so strong as to cause the whole body to bound from the floor in a position of opisthotonos.

Sometimes during the intervals between attacks the patient regained consciousness, and entered into conversation, at other times the spasms followed in quick succession. These seizures presented three stages: (1) All of the attacks were preceded by vomiting or a violent effort at vomiting. (2) This was always followed by a sensation of choking, as though he were being strangled, and could not get air,—evidently a spasm of the glottis muscles. (3) He then fell unconscious to the floor, and the convulsions immediately supervened. During the first two stages there was always a sensation of dizziness. After from one to six or eight convulsions the attack subsided, and the patient went about his business.

Fluoroscopic examination and an X-ray picture (Fig. 1) showed a mass of foreign matter in the region of the cardiac end of the stomach. This mass was in the form of a ball or nest; no separate foreign substances could be detected in any other location. Further examination on the following day showed the abdomen to be flat and free from peritoneal irritation. There was slight ten-

derness over the cardiac end of the stomach. The patient's general physical condition and morale were excellent. There was a scar of median operation above the umbilicus.

Operation, May 3. Abdomen opened through left rectus muscle, and stomach brought into wound. Stomach secured with two supporting silk sutures. Transverse opening made in stomach over cardiac end. The hand introduced in this opening discovered a mass of metallic substances felted together and bound by chains into a nest. This was separated, and the following articles removed (Fig. 2): Seven pocket-knives, seven door-keys, twenty nails (two and one-half inches long), one small spoon, one button-hook, an ordinary pin, a knife-spring, and two watch-chains (one gold-plated, the other silver). The total weight of these things was sixteen ounces. The mucous membrane of the stomach appeared slightly congested, but otherwise normal. The musculature was apparently not hypertrophied. There were no peritoneal adhesions or evidences of irritation, excepting the adhesion of the stomach to the former scar. There was some dilatation of the left end of the stomach, induced by the weight of its contents and the ineffectual efforts of expulsion. The adhesion of the stomach to the former scar, which was about in the middle of the organ, had encouraged the development of a cardiac pouch. As is shown in the radiograph, taken in the recumbent position, the mass is lower than the normal location of the lower border of the stomach. The stomach wound was closed with chromic gut sutures, and the slack of the stomach wall taken up about two inches by making a longitudinal fold, approximating two surfaces about an inch broad. The patient was kept on nutrient enemata for five days, being allowed a small amount of water by mouth from the first. At the end of five days he was permitted fluid diet, and two weeks after the operation full diet. He was discharged from the hospital cured at the end of three weeks.

An examination of the material removed from the stomach showed that the pearl and bone handles had been digested from the knives. There were a few particles of food and considerable mucus mixed with these things. The patient recognized one knife that he had swallowed five months before. The button-hook had been swallowed ten months before. It is evident that during the past year the stomach always contained some metallic foreign



FIG. 2.—Forty metallic articles, weighing one pound, removed from stomach of J. F. at the German Hospital, Brooklyn, New York, May 3, 1904. Pearl and bone handles digested from knives. Operation by Dr. J. P. Warbasse.

bodies. Articles remained in the stomach until they became disentangled and then passed on.

The copper parts of the knives were not bright, but dull in appearance, and there were no gross evidences of the presence of the chloride of copper. Nor did the patient present any symptoms of poisoning from copper salts. His appetite was always good.

The symptoms of tetany in this case were not recognized until after the operation, when a history of his recent attacks was obtained, and the facts concerning previous attacks inquired into. The symptoms described by Trousseau, Chevostock, Erb, and Hoffmann were not elicited. This man, as was the case with the patient reported by Dr. Cunningham, had repeatedly fallen in tetanic convulsions, and been in three different hospitals, and the disease failed of recognition. The peculiar and dramatic interest attracted by his other condition undoubtedly turned attention from the more important and interesting tetanic feature of the case.

The cause of this man's symptoms cannot be found in pyloric stenosis. What moderate dilatation he had was due to the dragging down by the weight of foreign matter, and to the efforts of the stomach to empty itself of a mass that could not pass through the pylorus. As a matter of fact, a normal pylorus may be the cause of dilatation of the stomach if it is not large enough to accommodate the contents which the stomach is trying to extrude. As far as the effect on the stomach wall goes, it amounts to the same thing as stenosis of the pylorus. As to fermentation of food particles among the foreign bodies, it would seem probable that enough of the chlorides of iron and copper would be evolved to inhibit this. It seems to me that this case speaks for the mechanical theory of the etiology of gastric tetany.

INTRA-ABDOMINAL TORSION OF THE ENTIRE GREAT OMENTUM.

BY CHARLES L. SCUDDER, M.D.,

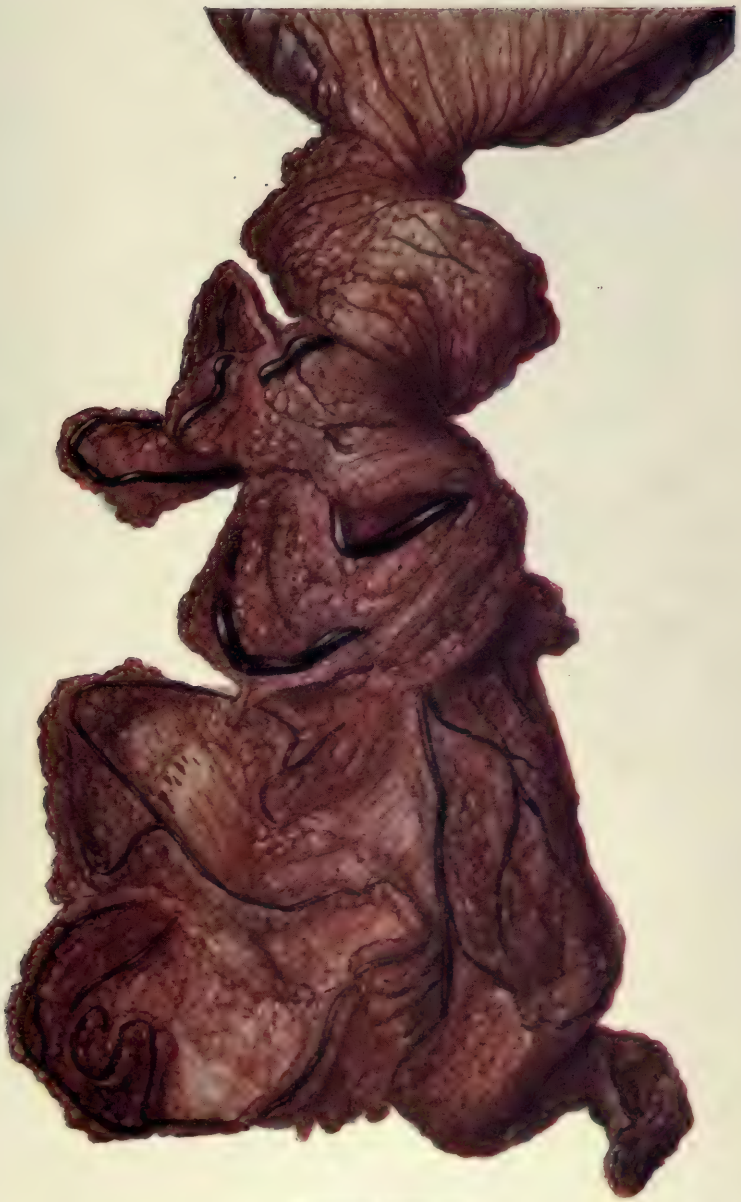
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H. W.; man; aged twenty-five years; occupation, shoeshop employee; entered the Massachusetts General Hospital July 7, 1904. He had been taken ill seven days previously with abdominal pain and vomiting. The pain was general over the abdomen, but gradually became localized in the right side. The bowels did not move for three days. He did not vomit after the first day. He came to the hospital "because the belly was getting filled up."

Upon examination, it was found that the heart and lungs were normal; the abdomen was full. There was no hernia. The left side of the abdomen was comparatively soft. There was no general muscular rigidity. Upon the right side of the abdomen was felt a mass occupying the whole of the right iliac fossa and extending to the right hypochondrium and to the middle line. This mass was protected by muscular spasm. The mass was rather indefinite in outline. It was dull to percussion. It was not movable. It was not markedly tender. There was slight tenderness upon the right side upon rectal examination.

Operation eight days after the initial symptoms. A right semilunar incision revealed a slightly adherent omentum. The finger palpated a friable, dark, rough omentum with some old free blood in its meshes. The vessels of the omentum were thrombosed. The omentum was followed down into the pelvis, separated from the side of the rectum and the wall of the pelvis, and freed from the peritoneum over the iliac vessels and upward to the transverse colon. The bowel lying beneath the omentum was in every way normal. The transverse colon showed no abnormal appearances. In the right hypochondrium was a mass the size of a large orange. This mass, continuous with the omentum, was extremely firm, and proved to be the tightly twisted portion



Torsion of omentum.

of the great omentum lying close to the transverse colon. The omentum was twisted several times upon itself. The condition of the omentum as seen at the operation is well shown by Mr. Aitken in the accompanying illustration. The whole great omentum was tied off with silk in sections, just below the transverse colon, through normal omental tissue. The omentum was extremely friable and roughly granular. The appendix was discovered beneath the omentum, and, being somewhat œdematous, was tied off with silk, removed by the actual cautery, and buried with a purse-string suture. The abdominal wound was closed with through-and-through silkworm-gut sutures. The man made an uninterrupted recovery, and left the hospital nineteen days after entrance, apparently well.

The pathologist, Dr. W. H. Wright, reports that the appendix, six centimetres in length, was thickened, the peritoneum injected and roughened in places, showing dense, fibrous adhesions; the walls of the appendix were much thickened and œdematous, The lumen of the appendix contained considerable mucopurulent material. Diagnosis, a subacute appendicitis.

As regards the omental specimen, it consists of a mass of soft tissue, and presents the appearances of a great omentum in which the fat is abnormally large in amount. The specimen is twisted upon itself, probably one and one-third times. There is no fibrinous exudate or inflammatory tissue in and about the twisted portion. The blood-vessels of the specimen are generally filled with blood, and the whole tissue has a reddish color, as from congestion. There is no gangrene.

Before operation, this was thought to be simply a case of appendicitis, although not particularly characteristic of the onset of an attack, and the mass felt was supposed to be adherent omentum over an inflammatory area. The operation revealed an unusual condition. The ligatures below the transverse colon were placed fairly near together, as many large vessels required tying. In the removal of any portion of the omentum, as in large herniæ, it is wise to include a rather small amount of omental tissue in the ligature in order to insure absolute hæmostasis. The ligatures in this case were placed in sound omental tissue close to the transverse colon.

Torsion of the whole large omentum is extremely rare. Certain cases of torsion of parts of the omentum have been recorded. Almost all of these have been associated with hernia. Two instances of omental torsion unassociated with hernia are the cases of Noble (*American Journal of Obstetrics,* 1904, Vol. xlix) and of Eitel (*New York Medical Record,* May 20, 1899).

Noble's case was that of a woman, twenty-four years old, unmarried, who was thought to have an acute appendicitis. Operation was suggested and refused. Six days later, being no better, an abdominal incision discovered a normal appendix and a twisted process of omentum attached to the fimbriæ of the right Fallopian tube. Coagulation necrosis was complete in this portion of the omentum. The twisted process was removed. Recovery was complete.

Eitel's case was that of a heavy man, forty-four years old, with ascites. After tapping the abdomen twice and withdrawing several gallons of fluid, an abdominal incision discovered a twisted great omentum with greatly distended veins. The torsion was corrected by untwisting, and the omentum was spread out over the intestines in normal relation. No untoward symptoms appeared. The patient recovered.

I have carefully examined the literature of all reported instances of omental torsion, and in every case an abdominal hernia existed, excepting in these two cases and in the case reported for the first time in this paper.

Etiologically, these cases of torsion of the omentum are of interest. They may be arranged in four groups. First, those in which the omentum is found twisted and adherent in a hernial sac. Second, those in which the omentum lies twisted near to an empty hernial sac, the twisted omentum evidently having once occupied the sac. Third, those in which a hernia exists, and the twisted omentum is attached to some organ, but not apparently connected with the hernia. Fourth, those in which no hernia exists at all. It has generally been supposed that two points of more or less fixed attachment are necessary, around which fixed points the omentum is

rotated or swung until, by the passive congestion and coagulation necrosis, the twisted parts of the omentum become agglutinated, and the whole mass slightly adherent to neighboring organs.

Taxis has been assigned by Hochenegg as a cause of torsion of the omentum.

Martinaud regards the presence of a hernia in many of the cases as purely incidental, and not causative of the torsion in any sense. Payr (*Archiv für klinische Chirurgie,* 1902, Band lxviii, S. 501) has experimentally produced torsion of the omentum in animals. He formed gas cysts in the omentum by inserting metallic magnesium into the omental tissue. This splits the H_2O of the tissues to form $MgO_2 + H$; the MgO_2 is absorbed, leaving cysts filled with H gas. These cysts are usually multilocular, the largest being about four to five centimetres in diameter. Omental torsion was caused because of the presence of these cysts in the omentum. He tried introducing material into the omentum which had less specific gravity than the abdominal organs generally, but which did not exert any upward force as the light gas cysts did. He tried cork, wood, paraffin, and alder pith. He obtained torsion of the omentum with all these. He tried implantation into the omentum of a piece of liver, but no torsion resulted, because adhesions formed. Payr thinks that, because the veins are longer and more tortuous than the arteries, when the veins are compressed by a kink of some kind, that they become turgid and full of blood. The arteries form a tense elastic cord. The congested omentum turns about this cord, and once started the twisting continues. He compares a distended appendix to the conditions described above, in which case the mesentery represents the tense cord. In conclusion, Payr writes:

It is important to distinguish between internal and external causes of torsion. Internal being brought about by conditions of growth and circulation. The conditions of growth of a tumor and the variations in weight thus caused play an important rôle in the etiology of torsion. The blood-vessels

play an important part in the etiology as suggested above. Payr demonstrated that omental torsion may be caused experimentally in the absence of hernia or adhesions, and these three cases of Noble, Eitel, and my own here reported confirm clinically the results of Payr's experimental work.

The appended references to literature contain the most important papers published.

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HERNIA OF THE BLADDER COMPLICATING INGUINAL HERNIA.[1]

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THE fact that in one per cent. of cases of inguinal hernia there is an accompanying hernia of the bladder, endows this subject with great interest, and warns the surgeon to be careful lest he accidentally wound the bladder whilst operating for the radical cure of hernia. Wounds of the bladder in this operation are not so very uncommon,—more common, indeed, than the number of published cases would lead one to believe. Naturally one hesitates to publish one's failures, especially if they have a fatal issue. Now the protruding portion of the bladder is normally very thin, much resembles a hernial sac, and can without much difficulty be included in the ligature of the sac; again, it may be covered with fat which resembles subperitoneal tissue, and it may thus be wounded in the dissection of this from the supposed hernial sac.

Not a few cases of wound of the bladder are produced by the needle in closing the hernial opening.

Many of these accidents are not recognized until either bloody urine is passed or the bad condition of the patient induces the surgeon to open up the wound and look for the cause. Again, urine may escape from the wound, especially if the bladder has been injured extraperitoneally. If the leakage occurs into the peritoneum, then, of course, a fatal result is almost certain. Occasionally the protruding portion of the bladder is a mere diverticulum, and so thin that it has been punctured for a cyst. In such cases tying off the protruding portion has been successful in some instances. Of course it was

[1] Read before the Canadian Medical Association, August 23, 1904.

not recognized at the time that the cyst was a diverticulum and that the bladder was wounded.

Dr. Farquhar Curtis (ANNALS OF SURGERY, Vol. xxi, 1895) has written a most interesting article on "Bladder Wounds in Operations for Hernia." He collected forty-one cases in which there was a mortality of 25 per cent. In twelve out of eighteen cases sutured, primary union was obtained. In many of the cases in which a leakage of urine occurred after operation, the sinus closed spontaneously in from a few days to four months.

Many of these cases occurred prior to the introduction of antiseptic surgery, so it would not be fair to draw too many conclusions from them as to the fatality of bladder wounds. The danger chiefly lies in the tying-off of the sac with the thinned bladder and returning the stump to the abdominal cavity, where, after a short time, there may be an escape of urine into the peritoneal cavity. Many of these fatal cases are not reported. I know of at least two. When it is recognized that the bladder is wounded, prompt closure with a couple of rows of suture will usually result satisfactorily, and the placing of a small drain for a day or two down to the sutured bladder will, if there be leakage, prevent any serious consequences. Curtis mentions cases where, even when the protruding portion of the bladder was tied off, the wound healed without a sinus. It is not necessary to keep a catheter in the bladder after operation.

Jaboulay and Villard (*Lyon Médicale*, 1895) report three cases of hernia of the bladder where in two cases the bladder was wounded and one died. In one case the whole bladder with the prostate was herniated.

The commonest form of hernia of the bladder is the extraperitoneal, where the bladder protrudes towards the lower and inner part of the sac,—the posterior and inner wall of the bladder forming the lower and anterior wall of the sac containing the bowel. In most cases the sac containing the bowel protrudes beyond the bladder, but its lower wall is continuous with the peritoneum covering the posterior wall of the bladder.

The bladder may be within the sac altogether, the intraperitoneal portion alone protruding, or there may be a hernia of both intra- and extraperitoneal portions. In all my cases it was evidently the extraperitoneal portion of the bladder which protruded, and the lower wall of the hernial sac was bounded by the bladder, the peritoneum forming this part of the sac being closely attached to the bladder and pulling that organ down with it as it protruded. In only one of the cases could any history be got connecting the hernia with the bladder.

CASE I.—E. T., aged fifty years, consulted me for a hernia from which he had suffered for some years, and for which he had never worn a truss. Whilst in the Northwest, he had, when lifting, felt something give way in the right groin, and he afterwards noticed a lump there; this lump on lying down disappeared. For the last year or two the swelling had become greater, and at times he has been seized with severe paroxysms of pain; has never had any difficulty in micturition.

On examination I found an inguinal hernia with a very large opening, through which the hernia could be reduced, leaving, however, a thickening supposed to be a sac. I ordered a truss for him, which he wore comfortably for some time, but of late, he tells me, the truss was quite inefficient and the cause of considerable pain. He could rarely reduce the tumor completely, and when reduced the truss would not hold it in place. Besides, he complained of much pain in the tumor, especially when wearing the truss, and demanded operation. This was agreed to, and he was admitted as a private patient into the Montreal General Hospital, November 22, 1901.

Operation.—On November 23, 1901, after the usual preparations, the patient was etherized and the usual incision made for the radical cure. The tumor was quickly come upon, and it was seen that the cord was to the outer side and not attached to the tumor, as is usually the case. The opening through which the sac protruded was very large, and there appeared to be no distinct neck to the sac. This sac was thin above, and through it could be seen the intestines, but below it appeared to be covered with fat, or rather a mass of fat surrounded the anterior part of the sac, which seemed to go towards the pubis. Not wishing to cut this off without knowing what it was, I began carefully to dissect it away.

I found this fatty tissue very granular, vascular, and difficult to separate; suddenly I opened into a smooth cavity, from which escaped an amber-colored fluid. I then immediately recognized that I had to deal with an opened bladder. The rent was several inches long, and the bladder beneath had much the appearance of a hernial sac, so thin was it.

Rather startled by this accident, I at once knew I had to deal with a hernia of the bladder. The rent was sewn up with a double row of Lembert sutures; the upper part of the sac when opened showed its anterior wall to be the outer and posterior wall of the bladder. The large opening, after transplanting the cord, was closed with chromicized-gut sutures, a space being left for a drainage-tube in case there should be a leak from the sutured bladder. A small, soft rubber catheter was placed in the bladder and left there for two days, to act as a drain and prevent tension in the sutured bladder.

The patient recovered well from the operation; had no temperature or pain; the tube was removed on the second day, and also the catheter, and from that time his recovery was uninterrupted. At present he is well, and there has been no return of the hernia. I have questioned him since carefully, and he tells me he has never had any trouble with his bladder, nor had he ever noticed any diminution of the size of the tumor after micturition; in fact, he had never the slightest trouble with his bladder, nor did he ever connect the bladder with the tumor.

CASE II.—*Right Inguinal Hernia with Hernia of Bladder, recognized before Ligating the Sac.*

M. L., aged forty years, has been suffering for some years from a rupture on the right side; he thinks it came from a strain received several years ago. The hernia could not be satisfactorily controlled by a truss, and he was sent to the Montreal General Hospital for operation.

On admission, January 15, 1902, it was found that he was suffering from a right inguinal hernia which could not be completely reduced. The opening was out of proportion to the size of the hernia. He had never noticed any connection between the size of the tumor and micturition.

Operation, January 16, 1902.—The usual incision for Bassini's operation was made, the external ring exposed, the aponeurosis of the external abdominal oblique slit up, and the sac ex-

posed. The first thing that was noticed was that the cord was to the outer side of the sac, and was not involved in it; indeed, it was quite apart from it. This condition, being the same as in Case I, excited my suspicions, and I carefully examined the sac and found that it could not readily be separated anteriorly and internally; that, in fact, it spread itself towards the pubis so that no distinct neck could be found. The upper and posterior part of the sac was freed and opened, and then it was found that the anterior wall of the sac was the posterior wall of the bladder, and the part internal and anterior was a very thin part of protruded bladder; this was proved by the introduction of a sound and making it enter the lower part of the sac outside the oblique muscle. The posterior part of the sac was ligated and the anterior returned, the cord transplanted and the opening closed, as usual, with chromicized-gut sutures.

The patient's recovery was normal and uneventful, and I have since heard that the result has been most satisfactory.

Case III.—*Right Inguinal Hernia with Hernia of Bladder; Sac Bilobate.*

J. C., aged fifty-four years, was admitted into the Montreal General Hospital, April 5, 1902, complaining of a swelling in the right inguinal region.

The patient, who is rather an undersized, poorly developed man, says he has not felt well for some years. About seven years ago he noticed that after lifting a heavy weight a swelling appeared in the right inguinal region. This swelling disappeared on lying down, and reappeared on exerting himself in any way when in the erect position. It gradually became larger, and its appearance was accompanied by a dragging sensation. He noticed that after micturition the size of the tumor somewhat diminished, but never entirely disappeared, except when in the recumbent position. He had worn several trusses, but none were satisfactory, all causing pain. Many years ago he had a bubo in the right groin, which was incised, and there is a large scar in that region.

On examination, and getting him to cough whilst standing, a considerable tumor appears in the right inguinal region, the opening through which it comes being very large.

Operation, April 11, 1902.—The usual incision having been made, the sac was exposed. After splitting up the external oblique muscle, a very large opening was seen, through which a mass

protruded the size of a small orange. The cord was behind the sac, but quite separate from it, and could be easily held out of the way. The sac when carefully examined was found to consist of two parts, separated by a groove, viz., an upper and outer and lower and inner; the upper sac was very thin, and through it the intestines could be seen moving; the lower sac was thicker and firmer and covered with a lot of vascular granular fat, and the sac ran towards the pubis.

From my experience of the above two related cases, I at once recognized that the lower sac was the bladder; this was proved by the introduction of a sound which, with some manipulation, was induced to enter the diverticulum protruding through the abdominal walls. A careful attempt was made to separate the two sacs, and when this was partially accomplished the upper sac was tied off and the whole hernia reduced. After transplanting the cord, the opening was closed in the usual way in Bassini's operation with chromicized gut.

The patient's recovery was uneventful, and he was discharged three weeks after operation. I have seen him quite recently (February, 1904), and he tells me he is perfectly well, and there has been no return of the hernia.

CASE IV.—*Right Direct Inguinal Hernia with Hernia of the Bladder and Hydrocele of the Sac; Wound of the Muscular Coat of the Bladder.*

A. W., aged thirty-eight years, entered the Montreal General Hospital, April 15, 1903, for the radical cure of hernia in the right inguinal region. He has also a fluctuating swelling which descends to the scrotum. The patient, whilst lifting a heavy weight some twelve years ago, felt something give way in his right groin, and noticed a swelling in that region. This easily went back; and he consulted a doctor, who gave him a truss, which he wore for a year, and then gave up because he thought himself cured, but since then every two or three weeks the tumor would reappear. He easily put it back, and thus on some occasions it would not return for a month. Latterly, although he could reduce the tumor easily, it would come back immediately, but never caused him any trouble until the day before he entered the hospital, when he was unable to reduce it. Has never had much pain; never could pass water whilst lying down; but the bladder was easily emptied while standing. Has always been healthy and has worked hard.

On examining the patient, a large, tense, smooth tumor, oval in shape, the size of one's closed fist, seen in the right inguinal region and extending into the scrotum; the tumor is dull on percussion. The testicle is below and external to the tumor and quite separate from it. The tumor could not be reduced, but is not tender.

Operation.—An incision about four inches long was made over the tumor, extending into the scrotum; the tumor was separated from the surrounding tissues, and it was noticed that the cord was not blended with it, but was to the inside and quite separate. The sac seemed to be lobulated and to contain fluid below and omentum above; the latter could be seen moving on the sac with respiration.

As complication with the bladder was suspected, the sac was carefully opened over the contained omentum, and then it was found that there was a collection of fluid in a sac in front. On passing a sound into the bladder, it was seen that the inner and anterior wall of the sac was formed of that organ. The omentum, which was partly adherent, was tied off and cut away, and then the sac was carefully dissected from the protruding bladder. In this dissection the muscular coat of the bladder was wounded, but the bladder was not opened. After suturing the wounded bladder, the sac was tied off and the bladder reduced. The usual Bassini operation was performed and the wound closed with four chromicized-gut sutures, care being taken not to injure the bladder in passing the sutures. On careful examination the hernia seemed to be direct.

The patient recovered rapidly and had no drawbacks during convalescence; he could quite easily micturate now whilst lying down. He was discharged twenty-two days after operation quite well, and there has since been no return of his hernia.

This case was much complicated by the fact that there was a sac of fluid in front of the tumor, not communicating either with the hernial sac proper or with the bladder.

It is most important to recognize hernia of the bladder when operating for the radical cure of hernia, and there are certain points to which my attention has been directed in the cases I have met with which would enable one to avoid mis-

takes. *First,* the inguinal opening is always large, out of proportion to the size of the protruding intestines. *Second,* the cord is not intimately associated with the sac of the tumor, but can be readily held aside without dissection; it is usually to the outer side of the tumor. *Third,* in two at least of my cases the hernia was a direct one, and in all had been produced by a sudden strain. *Fourth,* the difficulty of finding a neck to the sac, for the anterior portion of the sac stretches away towards the pubis, and is perhaps covered with granular and very vascular fat. In my fourth case the condition was complicated by the presence of a collection of fluid in front of the sac, which extended into the scrotum.

Having once wounded the bladder, as I did in my first case, the surgeon is always on the lookout for this complication, and readily recognizes it.

DERMOID CYST OF THE PELVIC CONNECTIVE TISSUE.

TWO CASES, WITH A CONSIDERATION OF TWENTY-FOUR REPORTED CASES.

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THROUGH the courtesy of Drs. Munro and Bottomley, of the Carney Hospital, I have had the opportunity of observing two cases of dermoid cyst of the pelvic connective tissue, which I report because of their rarity and importance.

CASE I.—H. B.; aged thirty-five years; married; housewife; has always lived in Massachusetts. Catamenia at eighteen. No pain. Apt to be irregular. Four children. Two living. Three miscarriages. Has not been well for ten years. Is easily tired, and not at all strong physically. Eight years ago, during one of her pregnancies, the attending physician discovered a tumor in the pelvis. Patient never paid any attention to this on account of lack of symptoms. Constipated for years and habitually takes laxatives. No appetite. No urinary symptoms.

Physical Examination.—Well developed and nourished. Pale. Head, neck, and chest negative. Abdomen,—no spasm, distention, or evidence of free fluid. Some tenderness, with an indefinite mass in lower left quadrant. Fluctuant tumor posterior to rectum and pushing the latter far forward. The upper edge of the tumor is beyond the reach of the finger and is felt obscurely over the pubes. Uterus displaced upward, is Y-shaped, either from fibroids or bicornate.

Operation by Dr. J. C. Munro. Oblique incision made along left edge of sacrum and coccyx. The latter was removed. In retrorectal space a multilocular cyst size of two fists was found. On separating tumor from the sacrum, the anterior wall of the latter showed a broad groove ending at the level of the third segment in a canal, half an inch in diameter and of indefinite length. From the anterior lip of this canal there was a firm band

of tissue connected with the cyst, which had to be severed. So far as could be seen, there was no direct communication between the cyst and the spinal canal. Laterally, the attachment of the cyst was firm and had to be tied and cut. Anteriorly, attachment to the rectum was not firm. The main cyst ruptured in dissection, giving escape to a thin fluid. Apparently all the cyst wall was removed, leaving a large cavity. Wound was partly closed with silkworm gut. Iodoform gauze drainage.

The further history is not remarkable. Patient made an uninterrupted recovery and has had no further trouble.

Pathological diagnosis is a dermoid cyst with a connective-tissue wall. The latter contains nerve-fibres.

CASE II.—W. C.; female; single; aged eighteen years. About six months ago noticed tumor in abdomen. This has gradually increased in size, and is at times tender and painful. No other symptoms.

Physical Examination.—Well developed and nourished. Heart and lungs negative. Immobile tumor in median line in hypogastric region. Extends into left iliac region and is composed of two nodules. The upper and larger mass is the size of a grape fruit, while the smaller and lower mass is the size of an orange. Both tumors are adherent to each other and to Poupart's ligament. Tumors feel like tense cysts, though there is no definite fluctuation. Diagnosis of adherent ovarian cyst was made.

Operation by Dr. J. T. Bottomley. Incision four inches long in the median line below the umbilicus. The peritoneal cavity was opened and a large fluctuant tumor presented. It was situated in the upper half of the pelvis, and the pelvic organs were markedly displaced to the right. The iliac vessels ran over the sac wall, and were so displaced forward that they lay just beneath the anterior abdominal wall. The peritoneum was incised, and with the iliac vessels was pushed to the right. The tumor was then tapped and a considerable quantity of light yellowish fluid containing hair and some curdy detritus escaped. An attempt was now made to excise the sac, which was adherent everywhere, but particularly adherent to the sacrum. It apparently followed the vessels beneath Poupart's. The patient did not stand the operation well, and her condition finally became so serious that work was stopped. The general peritoneal cavity was packed

off and the cyst filled with gauze packing. The cyst wall was now sewed to the anterior abdominal parietes. Abdominal wound partly closed. Sterile dressing. On the day following patient showed signs of hæmorrhage—pallor, rapid pulse, sighing respiration, etc. Ether was given and the abdominal wound was reopened. The pelvis was found filled with dark, fluid blood. No evidence of fresh bleeding. Gauze packing. On the second day there was still some oozing of dark blood, so the pelvis was again packed with gauze soaked with adrenalin 1–2000. Salt solution was given with stimulants. No subsequent bleeding occurred, but the patient grew worse, and died on the afternoon of the second day.

Pathological diagnosis was dermoid cyst. Wall was composed of dense connective tissue.

From a study of the cases in the literature, with the two new ones of my own, making twenty-five in all, a good idea of the clinical aspect of these tumors can be obtained. I have selected only those cases where the diagnosis is confirmed either by operation or autopsy.

These tumors are always subperitoneal, and most frequently lie above the levator ani muscle (eighteen cases in twenty-five). In eleven cases the tumor was retrorectal and on the left side; once only on the right (Sanger). Three times (Biernacki, Page, and Germain, Case I) the tumor was clearly median. Three times (Emmet and Mannel, two cases) the cyst was anterior in Douglas's cul-de-sac. In Schultze's case there was one cyst above, the other below the levator ani. The same condition existed in Hofer's patient, but here the upper cyst lay between the layers of the broad ligament. Marchand has reported a microscopic dermoid found at autopsy between the layers of the broad ligament (cited by Hofer). In a case described by Weinlechner there was in all probability two parts to the tumor,—one above, the other below the levator; but the description is not clear enough to determine this point. A similar condition probably existed in Walzberg's patient. The tumors described by Birket and Kuster lay below the levator between the anus and coccyx.

Gussenbauer (*Präger med. Wochenschrift,* 1893, No. 36) found accessory cysts placed laterally in addition to one in the median line.

I have been unable to find a case where the cyst was situated in the ischiorectal fossa. It is best to exclude the superficial anococcygeal dermoids from this classification, since they give rise to no pelvic symptoms.

The size of these tumors varies from the microscopic finding of Marchand to the enormous growth of Ord, which nearly filled the abdominal cavity. These are, of course, extremes, and as a rule these cysts vary from the size of a hen's egg to that of a child's head.

In shape these growths are round or oval, but may be irregular as they lie in the pelvis. For the most part they are soft and fluctuant, filled with fluid which microscopically shows fat, cholesterin, and cellular débris. Hair was found in the tumors described by Trzebicky, Biernacki, Page, and Germain (Case II), and bone in Walzberg's case. Bland Sutton ("Tumors Innocent and Malignant," 1903) states that teeth may be found in dermoids in this situation, but I have been unable to confirm this observation.

The cyst wall usually consists of connective tissue lined with epithelium, representing more or less completely the structure of the skin. The stratum corneum and the stratum Malphighii can sometimes be recognized. In Hofer's case the papillary layer of the corium was not present, but in those of De Quervain and Trzebicky this layer was easily demonstrated. De Quervain was also able to demonstrate smooth muscle-fibre in the cyst wall, while nerve tissue was found in one of my cases.

The ages of the patients in this series varied from eighteen to fifty-eight years. In four cases the age is not given. Two occurred between ten and twenty. Ten between twenty and thirty. Six between thirty and forty. Two between forty and fifty, and one between fifty and sixty.

Nineteen of the twenty-five cases occurred in women in the child-bearing period of life, the sex being feminine in

twenty-three of the twenty-five cases. In regard to sex, the dermoids are like the more complicated teratomata of this region, which are much more frequent in females. The teratomata are, however, usually congenital as distinguished from the dermoids which appear later in life. This is, of course, a clinical distinction, due to the fact that the dermoids, though congenital, take on growth and give rise to symptoms in adult life. On the other hand, teratomata occur very frequently in dead-born fœtuses or infants dying at an early age. In Calbet's collection of 117 cases, fifty were dead-born or died during the first days of life (Thèse de Paris, 1893). Twenty-nine out of eighty-one of Molk's cases were dead-born (Thèse de Strassbourg, 1868). Follin and Duplay reported seventy cases, sixty-one of which were still-born or died in the first month of life.

As might be expected, the dermoid cysts displace the pelvic organs more or less, the amount of displacement depending on the size and situation of the tumor. The rectum and vagina are described as being flattened, while the bladder and uterus are elevated, as a rule. In Deahna's case the bladder and urethra became gangrenous from pressure.

No definite clinical symptoms appear in these cases. The cysts may remain quiescent for years and give rise to no trouble or discomfort. The symptoms which appear may be divided under two heads, (1) Mechanical. The tumor simply by its presence may be an obstruction to labor. This was observed by von Biernacki, Page, and Sanger. In a similar way retention of urine and intestinal obstruction are caused. Retention is mentioned by Luksch, Deahna, and De Quervain, while obstruction occurred only in Deahna's patient. Lesser degrees of obstruction are more frequently mentioned, and we often meet with the expression "difficulty in urination and defecation." Krogius and Luksch mention œdema of the feet and legs, and Colonna observed mucus and blood in the stools. These symptoms can be attributed to obstruction to circulation, and it is possible that menstrual disturbances and dysmenorrhœa are due to this cause.

(2) Under the second heading, the symptoms are due to microbic infection of the cyst. We then have a rapid enlargement of the cyst and retention of urine, and intestinal obstruction results, with the addition of symptoms of infection,—rise of temperature, nausea, etc. This was well illustrated in Deahna's patient, and to a lesser degree in Emmet's case. It is worthy of note that in none of the reported cases did the tumor cause sciatica or obstruct the ureter.

I have avoided reference to rectal, vesical, uterine, and ovarian dermoids, though there is little doubt that some of the so-called rectal and uterine dermoids were primarily cysts of the pelvic connective tissue. Examples of these are reported by Danzel (*Archiv für klin. Chirurg.*, Band xvii, S. 442), Snyers (Méd. et Pharm., ii, 372, Paris), Gelstrom (*Central. für Gynäk.*), and others where dermoids ruptured into the rectum or vagina during labor. These, of course, might have been ovarian, but it is more likely that they were primarily situated in the pelvic connective tissue. Vesical dermoids may be ovarian in origin, becoming adherent, and finally rupturing into the bladder, or they may be primary in the bladder, as in a case reported by Martini (*Archiv für klin. Chirurg.*, Band xvii, S. 449). Clinically, dermoids of the bladder give rise to a distinct symptom complex, so they are simply mentioned here.

Formerly, these cysts were all supposed to be ovarian in origin till Sanger pointed out that the ovaries were intact. Further, the cases of Ord and De Quervain occurring in men refutes this idea. The later theories refer the origin to the fœtal period of life. Embryologically, these cysts contain tissues derived from one or two germ layers, ecto- and mesoderm. It is supposed that during development, bits of ecto- and mesoderm are misplaced, remain quiescent for a period of time, and finally give rise to cysts of more or less complicated structure. This theory finds support in experimental work in animals. In the development of the lower end of the body, all the germ layers are in intimate relation, and the misplacement of bits of the outer and middle layers may take place

during the formation of the spinal cord, when the proctodæum invaginates to meet the neurenteric canal, or during the development of the genito-urinary apparatus. The old theories referring the origin of these tumors to Luschka's gland and to remnants of the postanal gut are no longer seriously considered. The more complicated teratoid tumors derived from all three germ layers may be fœtal inclusions, that is bigerminal, or, according to some authors, they are derived from a fertilized polar body or a segmentation sphere displaced very early in embryonic life. This has given rise to much discussion, but it need not concern us here.

Apparently the dermoids and teratomata of this region show no tendency to malignancy, as I have found no reported cases.

In diagnosis, it is of prime importance to determine the immobility of the tumor. If the growth is movable, it is not a tumor of the pelvic connective tissue. Tumors in Douglas's cul-de-sac cannot be differentiated without operation, since here we may have an adherent ovarian cyst, fibroid of the uterus, etc. A fluctuant retrorectal tumor may be an abscess, serous cyst, echinococcus, or a dermoid cyst. One can only differentiate by tapping. The presence of hair in the urine or fæces is strongly suggestive of a dermoid of the pelvic tissue, but may mean an adherent ovarian cyst. The same may be said of hair appearing in considerable amount during labor or in the lochia. Prognosis must depend entirely on the individual case.

Treatment.—Radical excision of the whole sac wall is the only rational procedure where it is possible. This may be difficult or impossible owing to dense fibrous adhesions, and always is the case if there has been suppuration. Usually, if we can judge by reports, these cysts have a definite capsule which renders excision easy.

Tapping as a therapeutic measure is to be condemned. In Ord's case, tapping through the abdominal wall resulted in fatal peritonitis. Gangrene of the urethra and base of the bladder ensued from suppuration of the cyst after tapping in

TABLE OF CASES OF DERMOID CYST OF THE PELVIC CONNECTIVE TISSUE.

Author.	Sex, Age, Symptoms.	Size, Situation, and Peculiarities of Tumor.	Treatment.	Remarks.
COLONNA. Gaz. Med. di Torino, 1896, p. 200.	Female; twenty-eight years. One normal confinement. For five months difficulty in evacuating rectum. Feeling of pressure in perineum. Tender in left iliac fossa. Mucus and blood in stools.	Four centimetres above anus could be palpated a ball-like tumor pushing rectum forward. Upper limit not made out. Tumor soft and elastic. Uterus pushed up and to right.	Removed by parasacral incision.	Recovery, twenty-six days.
DE QUERVAIN. Archiv für klin. Chirurgie, 1898, Band lvii, Heft 1, S. 129.	Male; fifty-eight years. Has used a catheter for nineteen years. Retention of urine with false passage. Fæces ribbon-like.	Rectum displaced forward and to the right. Tumor reaches from third sacral vertebræ to within a finger's breadth of the navel. Contents: brown purulent fluid with epithelial débris, fat, and cholesterin crystals. Cyst wall: connective tissue lined with epithelium, outside of which is a layer of smooth muscle-fibre.	Incised and drained; after three perineal incisions drainage (extraperitoneal) from abdomen. Three weeks later remains of sac removed through parasacral incision.	Recovery, four weeks.
SKUTSCH. Zeitschrift für Geburtshülfe und Gynäkologie, 1899, No. 40.	Female; twenty-eight years. Three confinements at term. One abortion. Five months pregnant. Difficulty in urination and defecation.	Rectum displaced forward and to right by tumor, which is about size of child's head. Uterus elevated and vagina narrow and pressed forward. Tumor can be readily palpated bimanually. Contents: yellow albuminous fluid, which contains fat and cholesterin crystals and peptone. Wall of cyst composed of connective tissue lined with epithelium.	Partly excised through perineal incisions. Drainage.	Recovery.
SKUTSCH. Zeitschrift für Geburtshülfe und Gynäkologie, 1899, No. 40.	Female; twenty-two years. One normal labor. One abortion at two months.	Tumor in left half of pelvis reaching nearly to median line. Above reaches to promontory of sacrum, below to perineum. Contents as above, and in addition pseudomucin.	Perineal excision. Drainage.	Recovery.

WALZBERG. Die chirurg. Klinik in Göttingen, Jahresbericht, 1875–8, S. 121.	Female; twenty-six years. No symptoms.	Congenital tumor between anus and coccyx, size of two fists; cystic. Nearer to anus was a second tumor, size of an apple; also a third, size of a plum. Contents: peasoup-like fluid containing fat drops and degenerated epithelium, with a piece of bone.	Partial extirpation. A part reaching high into pelvis could not be removed.	Healing after two months' suppuration.
SOLOWJEW. Ref. Central für Chirurgie, 1884, No. 6, S. 96.	Female; twenty-nine years. One abortion. Irregular menstruation. Nervous symptoms.	Retrorectal tumor nearly filling the true pelvis. Lies more on the left side. Cyst contains yellow fluid with cholesterin crystals.	Tapped from vagina. After several days, incision to left of anus, with partial extirpation. Upper part of sac not removed for fear of opening peritoneum.	Two months' suppuration. Healing.
WEINLECHNER. Cited by Skutsch, 1877.	Female; thirty-six years. No symptoms.	Two dermoid cysts on anterior surface of coccyx.	Partially excised, partly destroyed with fuming HNO.	Recovery after two months.
KÜSTER. Verhandl. der deutschen Gesellschaft für Chirurgie, 13 Congress, 1884, S. 852.	No symptoms.	Dermoid cyst, size of hen's egg, between anus and coccyx.	Extirpation, suture.	This case is doubtful; probably belongs to anococcygeal dermoids.
EMMET. American Journal of Obstetrics, 1884, p. 852.	Female; twenty-two years. Repeated attacks of pelvic peritonitis. Dysmenorrhœa.	Dermoid cyst lying between peritoneum and levator ani muscle.	Laparotomy, excision. (Diagnosis before operation was ovarian cyst.)	Recovery.
TRZEBICKY. Wien. med. Wochenschrift, 1885, No. 13, S. 394, and No. 14, S. 422.	Female; thirty-five years. Difficulty in sitting. Increases in size with increase in intra-abdominal pressure (*i.e.*, straining). Tumor noticed for one and one-half years.	Tumor size of child's head in left perineal region. Uterus pushed to the right. Per rectum, tumor can be felt occupying whole left half of pelvis. Contents: yellow purulent fluid, with white clumps, hair, cholesterin crystals, and epithelial débris. Cyst wall lined with pavement epithelium.	Extirpation. Tumor found to consist of two parts not joining one another.	Healing after two months. Trzebicky mentions a case operated by Orlowsky. Tumor size of man's head under the skin of the perineum.

TABLE OF CASES OF DERMOID CYST OF THE PELVIC CONNECTIVE TISSUE.—*Continued.*

Author.	Sex, Age, Symptoms.	Size, Situation, and Peculiarities of Tumor.	Treatment.	Remarks.
BIRKETT. Guy's Hospital Reports, 1859, Vol. v, p. 262.	Female; twenty-five years. Prominence of perineum noted for two years.	Walnut-sized tumor between rectum and coccyx. Lies a little to the right of median line. Contents: usual dermoid contents.	Extirpation.	Recovery.
ORD. Medico-Chirurgical Transactions, Vol. lxiii, 1.	Male. No definite symptoms.	Large abdominal tumor tapped from abdomen. Died in five days of general peritonitis. Autopsy showed large dermoid having its origin between bladder and rectum. Nearly filled abdomen.	Tapping (death).	Quotes Wilks and Curling, Pathological Transactions, Vol. xiii, p. 148, case of dermoid cyst in man. Tapped from rectum. Eight years later was operated for stone, the nucleus of which was hair. At this time tumor could be felt to right of rectum, which was taken to be the remains of the cyst.
MANNEL. Habil. Schrift. Marburg, 1864, S. 63. Cited by Sanger.	Female; age not given.	Cyst, size of dove's egg, between peritoneum and levator ani muscle.		Tumor found at autopsy.
MANNEL. Habil. Schrift. Marburg, 1864, S. 63. Cited by Sanger.	Female; age not given.	Cyst, size of hens' egg, same situation as above.		Tumor found at autopsy.

DEAHNA. Archiv. für Gynäkol., 1875, Vol. vii, p. 305.	Female; eighteen years. Nullipara. Sudden pain in abdomen, distention, vomiting. Retention of urine.	Lies on left of pelvis behind rectum, and reaches above to midway between navel and symphysis. Rectum and vagina displaced to right.	Tapped from rectum. This was followed by suppuration of cyst, with rapid increase in size and resulting gangrene of urethra and base of bladder. Cyst evacuated by incision between anus and coccyx.	Ten months' suppuration. Plastic closure of urethro- and vesico-vaginal fistulæ.
PILCHER, L. S. Methodist Episcopal Hospital Reports, 1895.	Male; forty-five years. Symptoms of rectal obstruction and sciatica, followed by pus infection, with pointing through left great sacro-sciatic foramen.	Pelvis filled with immovable tumor, displacing rectum to right.	Left parasacral cut; coccyx excised; osteoplastic resection of edge of sacrum; enucleation of greater part of wall of cyst, which was cut away, with escape of hair, epithelial débris, and pus. Remnant of sac left behind swabbed with pure carbolic acid. Drainage.	Rapid contraction and obliteration of cavity. Recovery, remaining complete when examined nine years later.
VON BIERNACKI. Diss. Berlin, 1887.	Female; twenty-eight years. Entered clinic in labor. Primipara.	Tumor between rectum and sacrum reaching to within four centimetres of anus. Contents: purulent fluid containing hair.	Tapped from rectum. Forceps attempted, followed by craniotomy. Cyst suppurated. Repeated incisions.	Recovery after fifty-nine days.
SANGER. Archiv für Gyn., 1890, Band xxxvii, S. 100.	Female; forty-two years. Nine confinements. During last three cyst formed an obstruction to labor.	Tumor size of child's head; lay on right side of pelvis. Rectum and vagina displaced to left, uterus displaced upward. Lies above levator ani. Contents: brownish fluid containing epithelial cells, detritus, and cholesterin crystals.	Tapped from rectum. Nine months later removed by perineal route.	Healing in three weeks.

TABLE OF CASES OF DERMOID CYST OF THE PELVIC CONNECTIVE TISSUE.—*Concluded.*

Author.	Sex, Age, Symptoms.	Size, Situation, and Peculiarities of Tumor.	Treatment.	Remarks.
PAGE. British Medical Journal, 1891, Vol. i, p. 406.	Female; forty-seven years. Seven difficult labors. Tumor noted at fifth confinement twenty years previous; sixth labor, difficult; seventh labor, craniotomy. Difficulty in evacuating bladder and rectum.	Tumor size of cricket-ball felt below umbilicus (movable). Below and posterior to this is a large elastic tumor reaching nearly to umbilicus. This tumor nearly fills pelvis. Rectum and vagina displaced forward, and latter is pressed against symphysis and much longer than normal.	Tapped from rectum. Two days later suppuration, with fever, vomiting, etc. Transverse incision behind anus. Cyst drained and sac removed.	Recovery in six weeks.
SCHULTZE. Deutsche med. Wochen., 1895, No. 22, S. 352.	Female; thirty-three years. Seven confinements; at fourth midwife noted tumor. Last labor difficult. Six weeks pregnant.	Tumor composed of two cysts,—one above, the other below the levator ani (each size of an egg). Lies between rectum and pelvic walls, reaching from anus to the left sacro-iliac synchondrosis. Contents: brown fluid.	Tapped from rectum, and after two months removed through incision (perineal).	Recovery and normal termination of pregnancy.
HOFER. Diss. Halle, 1896.	Female; thirty-seven years. Three confinements. Last confinement one year previous. Tumor noted for six years.	Tumor, size of child's head, in left gluteal region. Vagina pushed to the right. Tumor reaches into pelvis between layers of the broad ligament (left). Contents of cyst: yellow fluid in which is pavement epithelium, cholesterin, and detritus.	Diagnosis of dermoid cyst confirmed by tapping. Cyst excised by perineal incision.	Hofer mentions case reported by Marchand. The latter found a small dermoid between the layers of the broad ligament in a child.
LENNANDER. Hygiea, Band lxi, p. 431. Central. für Chirurgie, 1899, No. 28.	Female; twenty-six years. Three confinements with artificial aid.	Largest part of pelvis filled with tumor. Uterus displaced up and forward. Left Fallopian tube crosses tumor like a string.	Excised by left colpoperineotomy.	Recovery.

KROGIUS. Archiv. für klin. Chirurgie, No. lxi, S. 48.	Female; twenty-six years. Repeated attacks of intestinal obstruction since a child. Some œdema of feet.	Rectum displaced forward and to right. Tumor on left of pelvis, and can be palpated in iliac fossa.	Tumor could not be removed by laparotomy, so parasacral cut was made and coccyx and part of sacrum were removed and cyst excised. Drainage.	Recovery.
LUKSCH. Wiener klin. Wochenschr., 1899, S. 249.	Female; thirty-nine years. One child born dead (with forceps). In 1891, retention of urine (January). In July, 1891, noticed tumor. Later in year difficulty in defecation and urination, with œdema of feet.	Rectum displaced forward and to the left. Uterus displaced upward. Vagina long and narrow. Fistulæ in vagina and perineum. Cysts with dermoid contents.	Three cysts excised by removing coccyx.	Recovery.
GERMAIN. (Operated by Munro.)	Female; thirty-five years. Four confinements. Two living children. Three miscarriages. Constipation. Loss in weight.	Fluctuant tumor size of fist behind rectum. Rectum and vagina pushed forward. Uterus displaced upward. Indefinite tender mass in left iliac region.	Excision.	Recovery.
GERMAIN. (Operated by Bottomley.)	Female; eighteen years. Nullipara.	Fluctuant, tender mass in left iliac region extending into pelvis. Mass size of two fists; immobile.	Abdominal incision (attempted excision). Drainage.	Death from concealed hæmorrhage.

Deahna's case. In the patients of Page and von Biernacki, suppuration of the cyst caused by tapping necessitated immediate operation. Tapping followed by injection of irritants is mentioned only to be condemned. Incision and drainage can be resorted to where a hasty operation is demanded, as, for example, during labor, when the cyst is an obstruction. As a rule, this is not a satisfactory procedure, as is shown by the reports of von Biernacki and Solowjew, where this operation was followed by two months of suppuration.

The choice of operative measures must depend on the individual case. The lateral perineal incision extended is necessary along the edge of the sacrum, with or without excision of the coccyx gives ample room for any cyst not extending above the pelvic brim. For cysts rising into the abdomen, median laparotomy must be the operation of choice, or combined perineal and abdominal operation may be required. De Quervain was able to loosen the upper attachments of the cysts in his patient by an extraperitoneal operation, but this is exceptional. Page made a transverse incision between the anus and the coccyx, drained the cyst, and was able to remove the sac through this opening. Even after total removal of the sac, drainage is usually advisable on account of dead space.

SUMMARY.

1. Dermoid cysts of the pelvic connective tissue are of rare occurrence.

2. They appear most frequently in women in the child-bearing period of life.

3. Their most common situation is posterior to the rectum and above the levator ani muscle.

4. They can be cured only by radical surgical interference.

5. Their origin is to be referred to the fœtal period of life.

I have appended a table of the reported cases. Some of these were taken from the works of Sanger and De Quervain; others were derived from various sources. All were confirmed except the reports of Mannel and Weinlechner, which I could not obtain in the original.

THE ILIAC EXTRAPERITONEAL OPERATION FOR STONE IN THE LOWER URETER IN THE MALE.

BY HARRY ATWOOD FOWLER, M.D.,

OF WASHINGTON, D. C.

DURING the absence of Dr. H. H. Young, of Baltimore, on his vacation in the summer of 1903, the following two cases were referred to me, and form the basis of this communication.

CASE I.—Referred by Dr. H. M. Kaufman, of Washington, D. C., to whom I am also indebted for the following history.

D. R., aged thirty-six years; complaint, attacks of passing bloody urine and constant desire to urinate. The family history is negative.

Previous History.—Unusually healthy, except for trouble for which he seeks relief. He has never had an acute illness or any infectious fevers. He denies all venereal infection. His habits are exceptionally good.

Present Illness.—In 1879, at the age of eleven years, he was taken suddenly, in the morning, with a severe pain in the left side, just under the costal margin. The pain was sharp, cutting in character, and well localized in the left loin. It lasted only a short time. There were no urinary symptoms associated with or following this attack. He did notice, however, a sensation of warmth over an area as large as his hand, situated just below the left costal margin in the left mammillary line. This peculiar sensation has persisted up to the present time.

A few months later, without any pain or other urinary symptoms, he passed a large quantity of blood in the urine. This continued for twenty-four hours, after which the urine became perfectly clear, and there was no disturbance of urination. After this attack of hæmaturia, he was perfectly well for two years.

In 1881, while working on the farm, the hæmaturia again appeared without any warning, persisted for about twenty-four

hours, and passed away, leaving no urinary disturbance. For a period of eight years he was again free from any urinary trouble.

In 1889, while travelling, he had a similar attack of hæmaturia, which lasted about the same length of time, and disappeared again completely.

In 1903 he had his fourth attack of hæmaturia, this time lasting seventy hours. It was directly after this attack that he first noticed any vesical symptoms. There was a constant desire to urinate which lasted for two days, associated with dribbling of urine and pain, which he describes as an uncomfortable burning sensation along the urethra. This gradually passed away in a few days.

Status Presens.—No frequency or other urinary disturbance. Feels well, except for fear of return of hæmaturia and pain.

Examination.—General condition good. Mucous membranes good color. Conjunctivæ clear. No tophi. Chest, clear. Abdomen, negative, except for slight tenderness on deep palpation in the left renal region. Bladder was explored with a Thompson's searcher with negative results. Suspecting a renal or urethral calculus, the patient was referred to me for further examination.

Examination, June 6, 1903. *Urine.*—The urine, voided in three glasses, was examined immediately. Reaction, neutral; specific gravity, 1023; urea, 2.43 per cent. There was no albumen and no sugar. The urine in all three glasses was perfectly clear. The first contained a few shreds, which were found, microscopically, to be made up of mucous threads, together with a few leucocytes. Embedded in the mucus were numerous crystals of calcium oxalate; otherwise the microscopic examination was negative. Palpation of the left kidney region and along the left ureter was not painful.

Rectal.—The prostate was normal, and the microscopic examination of the secretion was negative. Nothing abnormal could be felt above the prostate by bimanual palpation.

Cystoscopic.—Under cocaine anæsthesia, a plain Nitze cystoscope was introduced. A rapid survey of the prostate orifice and the bladder-wall disclosing nothing abnormal, attention was at once directed to the left ureteral orifice. The ureteral papilla on this side was flattened; the ureteral orifice, small, wizened, nonpatulous, and appeared to be closed by a plug of mucus. Although

it was watched for several minutes at various times during the examination, no urine was seen to escape from this side.

The right ureteral papilla was very prominent, in marked contrast to the other side. The ureteral opening was large and patulous, and from it jets of urine were ejected with considerable force at intervals more frequent than normal. The associated to-and-fro movement of the trigone was very distinct. The right side of the trigone appeared to be hypertrophied, while the left side was distinctly atrophied. So marked was this contrast in the two sides of the trigone that the provisional diagnosis of a stricture of the left ureter at some point, probably in its lower part, was made.

To clear up the diagnosis, a Casper's catheterizing cystoscope was introduced. After one or two trials, the catheter was engaged and passed easily into the ureter a distance of four centimetres, when it met an impassable obstruction. In the attempt to pass the catheter beyond this point it buckled into the bladder, dragging on the ureteral orifice. The catheter was partly withdrawn and repeated efforts made to pass the obstruction, but without success. The bulging of the catheter into the bladder when the attempt was made to pass it beyond the obstruction was demonstrated to several visiting physicians.

This examination left no doubt as to the presence of a stricture of the ureter four centimetres from its vesical orifice, and, from the history, this was most likely due to a calculus lodged at this point.

The patient was accordingly referred to Dr. Deetjen for radiographs of the left kidney and ureter. Excellent plates were obtained. In the latter plate was to be seen a very distinct shadow in the left pelvic space, at a point corresponding to the obstruction as determined by the catheter. The diagnosis of a calculus impacted in the ureter just above its entrance into the bladder-wall seemed fully justified.

Iliac extraperitoneal ureterolithotomy was performed by Dr. James F. Mitchell, of Washington, assisted by the writer.

Operation, July 29, 1903.—*Left Iliac Extraperitoneal Ureterolithotomy; Suture of Ureter; Iodoform Gauze Drainage.*

An incision, beginning a little inside and above the anterior superior spine of the ilium and extending obliquely forward and downward towards the middle of Poupart's ligament, was made

and rapidly carried down through the muscles. Care was taken to avoid the internal ring. The peritoneum being exposed, it was retracted inward by stripping it up, thus exposing the psoas muscle and the iliac artery. The ureter was at once recognized adhering to the rolled-up peritoneum, from which it was separated by blunt dissection. A small strip of gauze was placed around it for use as a retractor. There seemed to be no dilatation of the ureter, its appearance varying little from the normal. Following it down into the pelvis, a hard nodule was felt lying deep down about one inch above the bladder-wall. Attempts were made to dislodge this upward, but without success. By strong retraction the stone in its deep-lying position in the pelvic ureter was readily exposed without enlarging the incision by a transverse cut across the fibres of the rectus. With good exposure, two mattress sutures of fine silk on a French needle were placed in the ureter, using the stone as a bobbin. Between the sutures so placed a small longitudinal incision into the ureter was made, and the stone easily removed by a pair of mosquito clamps. A ureteral bougie passed without obstruction through the wound into the bladder and upward to the pelvis of the kidney. Having determined the patency of the ureteral canal, the two mattress sutures were tied. It was not found necessary to reinforce them with Lembert sutures. A narrow strip of iodoform gauze to the wound in the ureter was brought out of the lower angle of the wound. The muscles were sutured with buried silver wire, and the skin with subcutaneous silver wire. Silver-foil dressing was used.

Postoperative History.—There was no leakage of the ureteral wound. Slight infection of the drainage canal delayed healing somewhat, but the patient was out of the hospital in four weeks. Recovery was complete. There has been no return of symptoms thirteen months after operation. The patient has been at work steadily since leaving the hospital; his general condition is excellent.

The calculus is small, oval in shape, measuring 1 by .5 centimetre, with a very rough, finely spiculated surface. It is very hard, and belongs undoubtedly to the oxalate of lime group.

CASE II.—H. R., aged thirty-two years; admitted July 18, 1903, complaining of "enlargement of the prostate" and frequent micturition.

Family History negative.

Previous History.—He denies all venereal infection. At the age of ten years, the patient had his first attack of "colic," which he describes as a sharp continuous pain in the right side just below the right costal margin. It was well localized and did not radiate. This attack lasted several hours, and was so severe as to require hypodermics of morphine. These attacks recurred at frequent intervals for about four years; they were similar to the first one, but associated with hæmaturia, which continued for several days. After a period of freedom from the colic for eight years he had in 1893 another attack similar to the previous ones, and associated with bloody urine. Up to this time there had been no other urinary disturbance. Following the severe attack of colic which occurred in 1893, the patient first noticed the symptom for which he now seeks relief. At first the frequency of micturition was only slightly increased. He had to get up once at night to urinate. This gradually grew worse, until the frequency was marked both day and night. There was no pain during micturition, and at no time was blood noticed, although, in 1897, the urine was examined microscopically and was reported to contain blood.

The necessity of passing his water so frequently day and night interfered so much with his rest that he became very nervous and generally broken down. His condition became so distressing, that in 1903 he came from the Southwest to St. Louis for treatment. A physician there told him he had an enlarged prostate; that he would either have to have an operation or wear a retention catheter.

While in St. Louis he had another attack of colic, lasting several hours, and requiring morphine to control the pain. He came on to Baltimore for the operation on the prostate which had been advised. No instruments had ever been passed into the bladder. Attempts to do so had been made, but his urethra was so sensitive that the catheter could not be passed beyond the sphincter, even after the use of cocaine.

Examination.—The patient is very nervous and restless, but otherwise healthy. Examination of chest, negative. There is marked tenderness over the right kidney and, especially, the right ureter. Deep pressure over the latter causes the patient to cry out with pain at the point of pressure and in the penis.

Rectal.—Prostate very tender, otherwise normal. Secretion

normal. Nothing could be felt in the ureters by bimanual palpation. Rectal examination was very painful, although there were no hæmorrhoids and no fissure.

Urine.—July 18, all three glasses cloudy; specific gravity, 1020; faintly acid. Microscopic: free pus-cells, few red blood-cells, no infection.

July 19, all three glasses clear. Microscopic: occasional leucocyte, no red blood-cells.

This marked difference in the two examinations was due to the fact that at the first visit the urine showed a small amount of blood and pus associated with the attack in St. Louis, while one day later it had completely cleared up.

July 20, the second glass contains a shred which, microscopically, is seen to be made up of mucus in which is embedded a great abundance of calcium oxalate crystals and a few leucocytes.

Cystoscopic Examination.—By using cocaine in the anterior urethra, then passing a catheter and depositing cocaine, 4 per cent., in the posterior urethra and bladder, the cystoscope was passed easily, and the examination was practically painless. No residual urine was found. Bladder capacity, 200 cubic centimetres. Mucous membrane was normal. Just behind the prostate lay a small, irregular mass which looked like a blood-clot and rolled from side to side as the patient was moved. The right ureteral opening was small, slit-like, emitting jets of clear urine at long intervals. There was no marked difference in the two sides of the trigone as in Case I.

The day following the cystoscopic examination, the patient came to the office, assisted by a friend, complaining of severe colic. He was all doubled up with the pain, which was chiefly *in the penis*. Pressure over the kidney and the bladder increased the pain. He would lie on his back, with the thighs strongly flexed on the abdomen, holding on to his penis with both hands, crying out with the severe pain. The next day he had another attack; this time the pain was localized in the right kidney, and was not referred. He urinated frequently, each time passing only a few cubic centimetres, containing red blood-cells and leucocytes in considerable numbers.

He was sent to Dr. Deetjen for radiographs of the right kidney and ureter. The latter plate showed a sharp, well-defined shadow in the course of the right ureter, apparently above the

pelvic brim. Catheterization of the right ureter seemed unnecessary.

Operation, July 29, 1903.—*Extraperitoneal Iliac Ureterolithotomy; Exploration of Entire Length of Ureter and Palpation of Kidney; Suture of the Ureteral Wound with Fine Silk; Small Iodoform Gauze Drain to Ureteral Wound; Heavy Silk Suture of Muscles and Fascia; Subcutaneous Silver-Wire Suture.*

An incision beginning midway between the crest of the ilium and the last rib, and extending obliquely forward and downward just within the anterior superior spine of the ilium was made, and rapidly carried down through the muscles. The peritoneum was stripped back towards the midline, exposing the psoas muscle and the iliac vessels. The ureter, which was slightly larger than normal, was easily recognized adhering to the peritoneum, and had been lifted up with it in the process of stripping it back. The ureter was freed by blunt dissection and a piece of gauze placed around it which was used as a retractor. On account of the apparent position of the calculus as seen in the X-ray plate, the upper part of the ureter was first explored, but nothing was found, although it was carefully palpated up to and including the pelvis of the kidney. Attention was then directed to the lower portion of the ureter, which was exposed by prolonging the skin incision downward towards the middle of Poupart's ligament, care being taken to avoid the inguinal canal. Following the ureter downward, a thickening about two centimetres long was found deep down in the pelvis about one inch above the bladder-wall. Within this thickened portion, which was evidently the result of an old periureteritis, a small, hard nodule could be felt and recognized as a small calculus. After repeated efforts, this was "milked" upward above the pelvic brim. Using it as a bobbin, two mattress sutures of fine silk were placed, care being taken to avoid including too much tissue in the sutures, and thereby producing a stricture when the sutures were tied. The calculus was then easily removed through a small longitudinal incision. A ureteral catheter, introduced through the wound, passed into the bladder and upward to the kidney. There was no stricture of the canal and no other calculi present. The wound in the ureter was then closed by tying the mattress sutures. These were reinforced by a single Lembert suture of the same material. A single strip of wide iodoform gauze was placed over

the incision in the ureter, and the muscle and fascia were then sutured with heavy black silk. The skin incision was closed by a subcutaneous silver-wire suture.

Postoperative History.—There was no leakage of urine. The drain was removed the second day. The wound was entirely healed on the tenth day, when the subcutaneous wire suture was removed. The patient made an uninterrupted recovery. He was up and about the ward in two and a half weeks, and left the hospital on the twenty-fifth day.

Immediately following the operation, the marked frequency of urination subsided. He was able to sleep through the night without having to urinate, and during the day held his urine three hours without any discomfort.

Note, April 18, nine months after the operation. The patient has been working steadily for the past eight months. He has been entirely free from attacks of colic. He does not get up at night to urinate. During the day he can hold his water on an average of three and a half hours.

Urine perfectly clear; acid; specific gravity, 1015; no albumen; no infection. Microscopical examination negative. Bladder capacity is smaller than normal. He complains when 300 cubic centimetres have been introduced, but after dilating the bladder a few times under pressure, 520 cubic centimetres were introduced without causing much pain The wound is perfectly solid. The patient's general condition is excellent. He says he never felt better.

Remarks.—In these two cases the diagnosis was made and the calculus located before operation by the special methods of examination which we now have at our disposal. In Case I, the ureteral catheter indicated the exact location of the stricture, and the radiograph confirmed the result of this examination, showing a well-defined shadow at the corresponding point in the ureter. In Case II, the ureteral catheter was not used, as the patient was suffering almost constantly from renal colic while under observation, and the nature of the pain, etc., made it very evident that the calculus was low down in the ureter. The radiograph, in this case, showed a well-defined shadow in the course of the ureter, which left no doubt as to the correct

diagnosis. It is to be noted, however, that we were somewhat misled as to the exact location of the calculus. In the radiograph, the shadow appeared *above* the pelvic brim, apparently about the middle of the ureter. At the operation, therefore, this portion of the ureter was first exposed; no stone being found, the upper half of the ureter was next explored with likewise negative results. The calculus was finally detected deep down in the pelvic portion of the ureter, just above the bladder wall. This difference in the position of the calculus, as shown by the radiograph, and as found at the operation, might be due to a change in the position of the calculus after the X-ray examination was made. That such a change of position was possible is evident from the fact that, although the ureter above the stricture was only slightly dilated, the stone was "milked" upwards to a point above the pelvic brim before it was extracted. It is evident, however, that considerable irritation had been caused by the stone in its deep lying position, as there was at this point a distinct thickening of the ureter, due, no doubt, to a periureteritis.

The striking feature in both of these cases was the marked vesical irritability. In Case I, the symptoms were so characteristic of stone in the bladder that this condition was at first suspected and the bladder explored by Thompson's searcher; while in Case II the frequency of urination day and night was a most marked and distressing symptom. It is also interesting to note that this patient presented exquisite tenderness of the whole urethra. The sphincter urethræ was so firmly contracted that it was almost impossible to force an irrigating solution into the bladder, or to pass a catheter beyond the sphincter, except by first instilling cocaine into the anterior urethra. This condition of hyperæsthesia of the urethra has largely disappeared since the operation.

Another striking feature of Case II was the localization of the pain during the attacks of colic. At times the pain was confined to the kidney region, radiating to the back; while at another time it was strictly localized in the penis, the patient

lying on his back, with the thighs strongly flexed on the abdomen, and the penis grasped with both hands.

While ureteral calculi give rise to no localizing symptoms by which we are able to determine from the symptoms alone in what part of the ureter the calculus has been caught in its descent from the kidney, it has been frequently noted that, when the stone lies in the lower portion of the ureter, it gives rise to marked vesical irritability, producing symptoms simulating those of vesical calculus, as in Case I, or marked frequency of urination with or without accompanying pain, as in Case II. In a case reported by Steward,[1] the symptoms were those of stone in the bladder, and, in spite of the negative exploration of the bladder for calculus with a Thompson's searcher (a cystoscopic examination was not made), a suprapubic cystotomy was performed. The bladder was found free from stone, however, but a calculus was palpated in the right ureter just above its entrance into the bladder-wall. The calculus was removed later by a transperitoneal operation.

In the cases reported by Morgan (Pitt's case),[2] Bishop,[3] Newman,[4] and Young,[5] in which the calculus was caught at the vesical orifice of the ureter, the vesical irritation was a marked symptom. In all of these cases the calculus protruded into the bladder cavity, covered only by very thin mucous membrane, as in Pitt's and Newman's cases, or free and uncovered, as in Young's and Bishop's cases. Hence, it is not surprising that the symptoms produced simulated those of vesical calculus, *i.e.,* frequency of micturition associated with pain referred to the glans penis. But, as has already been noted, calculi lodged in the paraischial and juxtavesical portions of the ureter also give rise to bladder irritation, as in the last case reported by Young (Annals of Surgery, 1902, xxxvii), and in Cases I and II above. In the last two cases found in the literature, those reported by Barling,[6] it is stated that no symptoms were present, which indicated that the calculi had left the kidney; hence, an operation for the removal of stones from the kidney was first undertaken in each case, and it was only by probing the ureters that the calculi were found lying deep down in the

pelvic ureter, just above the bladder, and removed by "milking" upward and extracting through a longitudinal incision higher up in the ureter. Unfortunately, the report of these cases is incomplete. We are not informed as to the presence or absence of bladder symptoms.

I believe that vesical irritation associated with attacks of renal colic suggests strongly that the stone has slipped into the ureter, and has been caught in its descent at a point low down in the pelvic portion.

Calculus of the lower end of the ureter is a rare condition, if we may judge by the number of cases reported. But we suspect the cases are more numerous than these statistics would lead us to believe. Except in those cases in which the stone is caught at the vesical orifice and projects into the bladder cavity, the diagnosis has been made before operation in comparatively few cases.

In the forty-six cases of stone in the ureter collected and tabulated by Morris [7] in 1899, in but very few was the diagnosis made before operation or autopsy. In the sixteen additional cases reported in his recent work on the kidney and ureter, the same statement is true. If, in the majority of cases, the condition was unrecognized, and if, in a considerable number of cases, calculus of the ureter has been found accidentally at autopsy, no symptoms having been present leading to a suspicion of their presence, it may be asked, How many cases go unrecognized altogether? There can be little doubt that this number has been large.

The improved methods of diagnosis enable us at the present time to recognize these cases with greater ease, and in a certain percentage of cases to determine the exact point of impaction. The condition can be recognized before the kidney has become disorganized, or the patient's life is jeopardized by such complications as pyonephrosis and calculous anuria, or made almost unbearable by years of torturing pain; and the question of early diagnosis is one of considerable importance. Although, as has been pointed out, a patient may carry a stone in the ureter for years without suffering with the usual attacks

of renal colic, or presenting any symptoms indicating its presence, and without showing any evidence of that slow, but progressive, destruction of the kidney often associated with this condition, yet such cases are unusual, and one can never say, in any given case, just what course matters will take. In this respect the condition is similar to that of inflammation of the appendix.

If a stone has remained impacted in the ureter for any considerable length of time, the chances of its being finally passed into the bladder are remote; and to leave it undisturbed is dangerous.

Young,[5] in his report in 1903, collected from the literature eighteen cases of stone impacted in the lower end of the ureter in the male which have been operated upon. To this number may be added another case operated upon by Young and included in a later report, two cases reported by Barling, and one reported by Steward in 1901 and overlooked in the above collection, and the two cases here reported, making twenty-four cases in all to date.

These cases are grouped, according to the operation, in the following table.

Operation.	Number.	Recovered.	Died.	Not Stated.
1. Intravesical	9	6	..	3
Suprapubic cystotomy	6	4	..	2
Catheter cystoscope	1	1	..	..
Lithotrite	1	1	..	..
Perineal urethrotomy *	..	..	..	1
2. Prerectal	1	1	..	..
3. Intrarectal	1	..	1	..
4. Transperitoneal	1	1	..	..
5. Iliac extraperitoneal	12	10	2	..
Totals	24	18	3	3

* Morris, in his work referred to above, p. 473, says: "The perineal incision is said to have been practised by Desault and Garengeot." In his interesting work, "Traite des Maladies des voies urinaires," Desault reviews the methods then in use for removing calculi impacted in the ureter at its vesical orifice. These he considered inadequate. He described a new operation and devised a new instrument, which he called a "coupe-bride," for use in these cases. Unfortunately, no diagram of this instrument is

The technique of the operation is as follows:

A perineal cystotomy was first performed. The finger was then introduced into the bladder in order to locate the stone caught at the vesical orifice of the ureter and exposed within the bladder. With the stone thus located, the coupe-bride was then introduced into the bladder through the wound, and the collar about the calculus, formed by the folds of mucous membrane, was engaged within the jaws of the instrument. This collar is then cut by sliding the blade of the instrument within its sheath. If the collar tissue is not prominent enough, or the beak of the instrument cannot be engaged between it and the stone, it was advised to grasp the tumor formed by the stone, within the jaws of the instrument and to cut the envelope thus fixed. One can increase at will the size of the incision. This procedure allows the stone to fall into the bladder, and it is then extracted in the usual way.

Although no cases are reported, this operation was apparently performed, and was considered by Bichat very much superior to the methods then in use.

There seems to be a wide divergence of opinion among operators as to the best method of attacking a stone lodged in this portion of the ureter. But, as our experience with this condition increases, there can be little doubt that a more uniform method of procedure will be adopted, and many of the operations which have been suggested or actually carried out will cease to have other than historic interest. The intrarectal route, which was employed in only one case,[8] and followed by a fatal result, has nothing to recommend it.

The perineal route, employed by Fenwick[9] in one case, has the great objection that it does not permit exploration of the ureter and kidney. In addition, the technical difficulties of the operation are such as to require very urgent indications for interference before one would be willing to undertake this operation.

given. From the description of the technique, however, one gets the impression that the coupe-bride was not unlike the Bottini instrument in its principle of construction.

In 1892, Cabot [10] suggested removing the calculus through a modified Kraske incision. In a recent article on "Calculous Anuria," he refers to this as follows: "This lowermost part of the ureter in the male is more difficult of access. The writer, in the article above alluded to, pointed out the fact that this portion of the canal could be reached extraperitoneally by a Kraske incision with removal or displacement of part of the sacrum." This sacral route has never been employed in the male. Morris, in his "Surgery of the Ureter and Kidney," records two cases, both female, operated on in 1900 by a modification of the sacral route. Cabot concludes his recent article as follows: "In some cases, the aid of the hand within the abdomen may enable us to remove a stone deep in the pelvis, through an extraperitoneal incision." It seems to us that the sacral route is not only unnecessarily severe and destructive, but is open to the same objection as that urged against the perineal operation, namely, that it does not permit thorough exploration of ureter and kidney. In every case of ureteral calculus, the ureter, above and below the site of impaction, should be thoroughly explored by bougies to determine the patency of the canal. Stricture of the ureter below the calculus is not infrequently found. This may be the chief factor determining the point at which the stone is arrested in its descent from the kidney, or it may result from the inflammatory changes produced by the foreign body within the canal. In every case a thorough examination should be made, and, if a stricture be present, it should be dilated by suitable means. Without giving careful attention to this important detail of any operation for the removal of ureteral calculi, we can expect only a greater percentage of recurrences, since one of the causes which leads to this condition has not been removed. In the earlier operations for stone in the kidney, the possibility of a stone in the ureter was overlooked, and in many a persistence of the symptoms necessitated a second operation. At present, no operator considers a nephrolithotomy complete and thorough without a careful examination of the ureter to insure its patency and freedom from calculi. It is quite as unpar-

donable to close a ureterotomy incision before a careful examination of the entire length of the ureter and the kidney pelvis has been made in order to determine the presence of other calculi or a stricture at some point in the canal.

The transperitoneal route has been employed but once in the male for a stone in the pelvic portion of the ureter. This case, reported by Steward, 1901, may be briefly summarized.

Man, twenty-four years, suffered three years from attacks of painful micturition, associated with hæmaturia. At time of operation, the urine contained considerable blood and pus. No pain, tenderness, or fulness over either kidney or ureter. The bladder was sounded with negative result, and two radiographs showed nothing abnormal. Nevertheless, the symptoms were so characteristic of vesical calculus that the diagnosis of encysted calculus of the bladder was made and a suprapubic cystotomy performed. The bladder was free, but a stone was felt in the right ureter at a point two inches above its vesical orifice. The suprapubic wound was closed, and, nine days later, an incision was made in the lower right linea semilunaris, and the abdomen opened. The stone was located and pushed up to a point just above the common iliac artery. The ureter was then incised and the stone removed. The incision in the ureter was closed with a continuous suture of fine silk, and the peritoneum was sewn over it. The calculus, cylindrical in shape, measured one-half by one-third inches, and weighed nine grains.

The good result in this case depended on the fact that there was no leakage from the ureteral incision. But one can never be sure in any case that leakage will not occur, even when the stone is dislodged from the point of impaction upward to a point where the sutures can be more easily and accurately placed, and the tissues of the ureteral wall are not damaged. If the urine be infected, as is not infrequently the case, the danger of infection of the peritoneal cavity is well-nigh unavoidable. This accident occurred in one of the three cases in which this operation was employed in the female, the patient dying of peritonitis. Morris says it is safer to remove the stone by an extraperitoneal rather than a transperitoneal operation, even when its existence and location have been determined by an intraperitoneal search.

These various operative procedures for the relief of this condition in the male represent various stages in the develop-

ment of our technique. When it is considered that, no longer ago than 1898, the pelvic portion of the ureter was held to be inaccessible, we can appreciate the rapid strides which have been made in the surgery of this region.

The iliac extraperitoneal route is generally held to be the best method of reaching and extracting calculi from the upper three-fourths of the ureter. As long ago as 1882 Bardenheuer operated in this way, and since then the method has become generally used. It seems to have been taken for granted, however, that the lower portion of the ureter is inaccessible through this incision. But a reference to the table here given shows that calculi impacted in this portion of the canal have been removed in twelve cases by eight operators.

In a large number of cases, it has been found possible, after exposing the ureter and locating the stone, to dislodge it upward and remove it through an incision higher up where the ureter is not so likely to be damaged and, for that reason, leakage is less likely to result.

In Case I, reported above, the stone was impacted at a point one inch above the bladder-wall. It was found impossible to dislodge it upward. An incision into the ureter was made over the stone at the point of impaction, the stone removed, the ureter explored, and the wound closed with two mattress sutures of fine silk. There was no leakage.

Furthermore, Young (Case I), after removing a calculus lodged in this situation, found, on examination, a tight stricture below the stone, one centimetre from the vesical orifice, which could not be dilated by bougies. Through the same incision, the bladder was drawn over and an incision made into its lateral aspect, through which the ureteral orifice was exposed and the stricture cut intravesically. This procedure is graphically shown by drawings accompanying his article in ANNALS OF SURGERY, Vol. xxxvii.

These cases show conclusively that this portion of the ureter is as freely accessible by means of the iliac extraperitoneal route as is the upper portion. They show that the ureter can be explored throughout its whole extent, down to

the bladder-wall; that the stones in the lower part may be either dislodged upward and extracted at a higher point, or removed by incision of the ureter at the point of arrest, and the wound sutured. Finally, these cases show that when there is present a stricture in the intramural portion of the ureter, the bladder may be incised, and the necessary additional procedures carried out, without making a separate suprapubic incision.

Extraperitoneal ureterolithotomy is a highly successful operation. The mortality should be even less than that for nephrolithotomy. And with an operation combining such small risk, with so great technical simplicity, this part of the urinary apparatus will be as fearlessly and as successfully exposed as the other portions which have long been considered more easily accessible.

The intravesical portion of the ureter is most readily and most satisfactorily reached by suprapubic cystotomy. This gives the best exposure; the operation on the ureter can be carried out under guidance of the eye.

Calculi in the intravesical or intramural portions of the ureter then are best reached by the suprapubic intravesical route; calculi impacted in the juxtavesical and paraischial portions should be removed by the iliac extraperitoneal route.

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TABLE INCLUDING THE CASES OF STONE IMPACTED IN LOWER END OF THE URETER IN THE MALE WHICH HAVE BEEN OPERATED UPON, ARRANGED WITH REFERENCE TO THE OPERATION.

	Reported by	Age.	Duration.	Side.	Prominent Symptoms.	Number.	Position.	Result.	Remarks.
(A)	1. Ceci.	(?)	Several years.	Right and left.	Symptoms of ureteral calculus.	Several removed from left ureter.	Juxtavesical.	Died in thirty-six hours.	Calculi also present in right ureter.
(B)	2. Fenwick.	18	Eighteen months.	Right.	Hæmaturia. Pain in glans after micturition. Lumbar pains.	One, size of small peach-stone.	Juxtavesical (?).	Recovery.	Cystoscope showed prolapse and villous tuft, which were removed by suprapubic cystotomy.
(C)	3. Young.	31	Seven years.	Left.	Colic. Constant desire to urinate, with pain in glans penis.	One 6 mm. in diameter, 3 mm. thick. Rough and spiculated.	Protruding into vesical cavity. Uncovered by mucous membrane.	Immediate recovery.	Left testicle markedly retracted.
(D)	4. Freyer.	53	Several years.	Right.	Frequency of micturition. Pain in glans. Hæmaturia.	One.	Intravesical.	Recovery.	Patient had urethral stricture. Negative exploration of kidney. Stone projecting from ureter detected by cystoscope.
(E)	5. Steward.	24	Three years.	Right.	Painful micturition. Hæmaturia.	One.	Two inches above vesical orifice.	Recovery.	Diagnosis of encysted calculus of bladder. Condition recognized by suprapubic cystotomy.
(F)	6. Helferichs.	Elderly man.	Three years.	Left.	Lumbar pain.	One, 2 x 5 cm.	Intravesical, projecting into bladder.	Recovery.	Large vesical calculus removed by suprapubic cystotomy. Patient died eight months later. Stricture of vesical orifice of ureter.
	7. Pitts's Case.	9		Right.	Vesical calculus.	One, ½ inch long.	Intravesical, covered by mucous membrane.	Recovery in six weeks.	Vesical calculus size of plum-stone removed. Ureter divided, and stone extracted with a probe with pressure by finger in rectum.
	8. Bishop.	13	"Long time."	Right.	Vesical calculus.	One, 1 inch long.	Protruding into bladder.	Recovery in two months.	
	9. Bishop.	8	Eight days.	Right.	Vesical calculus. Colic.	One.	Intravesical.	Recovery.	Vesical calculus removed eight days before.

10. Newman.	35	Several years.	Right.	Intermittent colic. Frequent micturition.	One, size of cherry.	Intravesical, covered by thin, vascular mucous membrane.	Not stated.	Thought to be fibroma, and removed by vulsellum forceps.
11. Newman.	54	Several years. Hæmaturia; 18 months.	Right.	Vesical calculus. No renal symptoms.	One, small red cherry.	Intravesical.	Not stated.	Vesical calculus, phosphatic, behind enlarged middle lobe of prostate. Removed by vulsellum forceps.
(G) 12. Twynam.	8	Sixteen months.		Abdominal pain. Hæmaturia.	One.	Near vesical end.	Recovery.	Ureter sutured.
13. Morison.	46		Right.	Patient in uræmic coma.	Two.	One inch from bladder.	Died.	Catgut closure.
14. Israel.	31	Six years.	Right.	Colic. Hæmaturia.	One.	Juxtavesical.	Died.	Died of heart failure in thirty-six hours.
15. Israel.	33	Nine years.	Left.	Pain in left kidney.	One, 3 cm. in diameter; 17 cm. long.	Filling entire ureter.	Recovery.	Nephrectomy followed by ureterectomy. Ureter ligated at bladder entrance and removed.
16. Israel.	...							Nephrectomy for pyonephrosis followed by total ureterectomy.
17. Young,	33	Ten years.	Left.	Colic.	Three.	Pelvic ureter.	Recovery.	Suture of ureteral wound.
18. Young.	29	Twenty-seven years.	Left.	Colic. Continuous pain in base of bladder, and constant desire to urinate.	One.	Juxtavesical.	Recovery.	Bladder incised through same wound and stricture at lower end of ureter incised. Sutured.
19. Young.	25	Five years.	Right.	Colic. Pain in bladder.	One.	One inch above bladder.	Recovery.	Sutured.
20. Barling.	20	Since childhood.	Left.	Lumbar pain. Vomiting. Hæmaturia.	One.	One inch above bladder.	Recovery.	Ureter studded with calcium oxalate. Sutured.
21. Barling.	33	Two years.	Left.	Colic.	One.	Three inches below pelvic brim.	Recovery.	Stone removed from urethra in childhood. Sutured.
22. Fowler.	36	Twenty-five years.	Right.	Colic. Symptoms of vesical calculus.	One.	One inch above bladder.	Recovery.	Sutured. No leakage from ureteral wound.
23. Fowler.	32	Twenty-two years.	Right.	Colic with hæmaturia. Frequency of micturition marked.	One.	One inch above bladder.	Recovery.	Sutured. No leakage from ureteral wound.

(A) Intrarectal. (B) Prerectal. (C) Catheter cystoscope. (D) Lithotrite. (E) Transperitoneal. (F) Suprapubic cystotomy. (G) Iliac extraperitoneal.

UNDESCENDED TESTICLE.

BASED ON A STUDY OF SEVENTY-SEVEN CASES.[1]

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THE deformity resulting from a partial or faulty descent of the testicle has been recognized for centuries, and has been commented on by many of the earlier writers; yet not until the last half-century has the condition been given the prominence which it merits on account of its comparative frequency and importance from a surgical stand-point. The literature abounds in reports of single cases, and articles dealing with special branches of the subject; yet there is a notable lack of valuable statistics drawn from the careful study of a large series of cases. There exists a wide variance in the opinion of surgeons as to the proper method of treatment, and of pathologists as to the significance of the condition. It is interesting to note that mention of cases of abnormal position of the testicle was made in the works of Paré, Meibomius, and Salmuth, and, antedating these, from the fourteenth century we get the supposedly authentic information that Tamerlane, the conqueror of Western Asia, was himself afflicted with this deformity.

John Hunter,[1] in his earliest published work, first gave the subject prominence by describing the normal descent of the testicle in the fœtus, and mentioning abnormalities in this descent. The first surgical operation to correct the position of an undescended testicle was performed by Koch, of Munich, in 1820. Lecompte[2] in 1851 mentioned the frequency of

[1] Seventy-four of these cases were treated at the Massachusetts General Hospital, and are included in this report through the courtesy of the Visiting Staff.

malignant disease, and most writers in the first half of the last century dwelt exclusively on this point. (Arnott,[3] 1848; Gowers,[4] 1849; Spry,[5] 1857; Johnson,[6] 1859.) Godard[7] in 1857 wrote the first exhaustive article on the subject. Curling,[8] in 1866, in his work on "Diseases of the Testis," dwelt especially on this condition. Since then no elaborate work covering the entire subject has appeared until the publication of the Hunterian Lectures on "The Imperfectly Descended Testicle," by W. McAdam Eccles.[9]

There should be a distinction drawn between the terms undescended testicle, by which is meant one which has been arrested at some point in its normal course of descent, and imperfectly descended testicle, as used by Eccles, and which includes the above class as well as the various forms of ectopia.

The term ectopia of the testicle is used to designate a malposition of an organ which in its descent has deviated from the normal course. There are three forms of ectopia: (1) That in which the testicle occupies a position in some part of the perineum. (2) In which the testicle is situated in Scarpa's triangle, often referred to as the crural form. (3) In which it is placed near the root of the penis, or subcutaneously above the inguinal canal.

These positions correspond to the attachments of certain fibres of the gubernaculum testis, which fibres undoubtedly are instrumental in bringing about the malposition. Tuffier[10] reports that in a dissection of three cases the attachment of the gubernaculum was never found in the scrotum. In one of his cases, a distinct band of gubernaculum was found traversing the perineum to its attachment near the anus.

The term monorchidism is often erroneously used to designate a condition where it is impossible on superficial examination to locate one testicle. In reality this is a misapplication of the term, which should be restricted to entire absence of one testicle, a condition of doubtful occurrence except in hermaphroditism: the correct nomenclature would be monocryptorchidism. An individual in whom neither testicle can be located is a double cryptorchid.

Curling reports a case of fused testicle consisting of one organ with two epididymes and two cords. Christopherson [11] reports a case where at operation he found both cords passing out through the same canal, and both testes, one rudimentary, on the same side of the scrotum. Polyorchidism is extremely rare. Only one authentic case has been reported (Lane [12]) in which the condition was verified by autopsy and microscopic examination. Many cases thought to be examples of this condition are undoubtedly tumors. In the following consideration of the subject, attention is paid only to the undescended or partially descended testicle.

Occurrence.—It is very difficult to compute with accuracy the percentage of individuals who have undescended testicles. In the first place, hospital statistics are misleading, for patients seeking treatment with this condition usually present themselves for some complication such as hernia, inflammation, etc., rather than for the relief of the deformity itself.

The most accurate statistics obtainable in adults were made by Marshall, quoted in Kocher's "Surgery," who in the examination of 10,800 recruits found twelve cases,—one double, five right, and six left,—that is, 1 to 900. This, even, is inaccurate, for men, recognizing the fact that they were imperfect in this respect, might not apply for the army.

As the testicle, undescended at birth, very frequently completes its descent during childhood, the percentage of occurrence varies in inverse ratio to the age of the individual up to puberty. Various authorities place the limit of age, after which descent is unlikely to take place, from the first to the fourteenth year. Curling states, however, that, if the testicle is not descended at one year, it is very unlikely to come down, but the statistics of other observers and the following cases would tend to refute the statement.

Case 3.—Aged fourteen years. Right undescended testicle with hernia. Left testicle descended at five years.

Case 30.—At age of thirteen right testicle could not be felt. One year later it was found subcutaneously above the external ring.

A case, not in the table, brother of Case 74, had both testes in canal up to age of thirteen, when they descended, massage having been used.

Sach,[13] in an examination of 143 male infants, from one to four months old, found 14 per cent. of cryptorchids, twelve cases being double cryptorchids. Wrisburg, quoted by Curling, examined 103 male infants at birth, and found that 30 per cent. of them had one or both testicles partially descended. In twelve cases, one or both testicles were still retained within the abdomen; but three weeks later he examined ten of these twelve, and found in every case the organ in normal position.

Gubernaculum.—As the gubernaculum undoubtedly plays an important part in the descent of the testicle, a brief description of its development and association with the testicle is in order.

It is derived from a fold of peritoneum covering the Wolffian body, and extends in early embryonic life from the lower part of the primitive kidney to the inguinal region. The testicle is developed from the genital fold, lying between the Wolffian body and the median line. As it develops, the Wolffian body shrinks; part of it, however, forming the epididymis and the vas deferens. The gubernaculum transfers its upper attachment to the lower portion of the testicle. It is composed at this time of a fold of peritoneum surrounding fibrous connective tissue. Later, smooth and striped muscular fibres appear, probably derived from the abdominal muscles. As the lumbar spine grows, the gubernaculum holds the testicle in a fixed position, so that at the end of the sixth month it lies close to the internal abdominal ring. Now the gubernaculum extends through the inguinal canal and has its main attachment at the base of the scrotum. Fibres, however, find attachment in Scarpa's triangle, the perineum, and at the root of the penis.

It is a much disputed point whether the gubernaculum assists in the descent of the testicle by muscular contraction, cicatricial contraction, or whether its rôle is simply a passive one. At the sixth month, with the descent of the gubernaculum

into and below the inguinal canal, a finger-like process of peritoneum—the processus vaginalis—accompanies it and passes into the scrotum, where the lower portion later forms the tunica vaginalis, the upper portion being obliterated.

Cause.—The precise cause of arrest of the testicle in its normal descent is hard to determine, but is invariably due to some defect in development during embryonic or fœtal life. In general, abnormalities of the mesorchium, gubernaculum, inguinal canal, or of the testicle itself, together with the epididymis, ducts, and vessels, are assignable as causes in most cases.

As a result of fœtal peritonitis, adhesions may persist which prevent the testicle from entering the internal ring; while in infancy and childhood the pressure of a truss used to withhold an inguinal hernia may also produce the same effect.

Several of the older authorities mentioned heredity as a prominent etiological factor in this condition. Godard believed in its importance, and cited two cases, but of late the tendency has been to treat the matter as of little consequence.

Case 18.—Man, present age twenty-nine, with right undescended testicle; has a son two years old, with neither testicle descended.

Case 74.—Man, twenty years old, a double cryptorchid. His younger brother had both testicles descend to scrotum at age of thirteen.

Varieties.—An undescended testicle may be classified according to the position which it occupies. Such classification is in many cases inaccurate, for the organ frequently changes its position.

A testicle may lie (1) entirely within the abdominal cavity, a condition known as abdominal or iliac retention; (2) in the inguinal canal, inguinal retention; (3) just outside the external ring, in close relation to the pubic bone, pubic retention; or (4) in the extreme upper part of the scrotum, pubo-scrotal retention. Occasionally, with the testicle itself lying entirely within the abdomen, its epididymis is found to occupy the inguinal canal; and in some cases of inguinal retention the

epididymis has descended to the scrotum. But it is easy to understand how one variety may readily pass into another; for example, an inguinal testicle can often be pushed into the abdominal cavity, while one occupying the pubic position frequently enters the canal as a result of muscular action.

Side.—From an examination of the table, it will be seen that the right side is more often affected than the left, for, out of seventy-seven cases, fifteen were double cryptorchids, and in the remaining sixty-two cases thirty-nine were right and twenty-three were left.

Eccles has stated that the right testicle was very much more often arrested than the left, which is in accord with the statistics of most writers. This is to be expected, in view of the fact that the left testicle is normally placed lower than the right, due perhaps to a greater length of the spermatic cord.

Position.—It is well known that the inguinal variety is by far the most common, and the statistics based on the series of cases are in accord with this fact.

Abdominal retention, 17; inguinal retention, 51; pubic retention, 18; puboscrotal retention, 5; subcutaneous, above external ring, 1 (ectopia).

As will be shown later, the inguinal variety is most prone to the various complications and inflammations, and would therefore be more often seen by the surgeon.

In all cases of undescended testicle there is a certain amount of atrophy of the corresponding side of the scrotum. The degree of atrophy varies very markedly. Disregarding the cases of infants and very young children, in whom the precise size of the scrotum is hard to determine, it may be said that the degree of atrophy has some definite relation to the position of the testicle on that side. In high arrest, that is, in abdominal or high inguinal cases, the scrotum in late youth and adult life is usually found to be very much atrophied; while if the testicle is placed just outside the external ring, perhaps occasionally entering the canal, the amount of atrophy of the scrotum is less marked.

Symptoms.—Many men go through life with a single

undescended testicle without symptoms of any kind referable to that defect. In fact, it is probable that the great majority of undescended testicles, especially such as are retained in the abdomen, or have reached a high position in the scrotum, give rise to no trouble whatever except such as would be caused by the knowledge of such imperfect development. French writers dwell on the prevalence of sexual neurasthenia among these men, giving it as a common cause for nervous debility or anxiety; but in this country, as far as can be ascertained, this symptom is not prominent.

The undescended testicle is more commonly the seat of inflammatory conditions than one which is normally placed, for the scrotum forms an admirable covering for the protection of the testicle. This body, lying suspended and loose in the cavity of the scrotum and surrounded by a serous membrane, is capable of great mobility, and can therefore easily slip about within the scrotum, and thus avoid injuries from blows and squeezes (Gray). The testicle retained within the abdomen is free from trauma, and, as Eccles has stated, is as little liable to attacks of traumatic inflammation as is the normally placed ovary.

The same cannot be said, however, of a testicle which is retained within the inguinal canal, or is situated in the pubic region. Such an organ, from its position alone, is very liable to injury. The comparatively fixed position makes it impossible for it to escape the force of blows and the effect of pressure from without, while the sudden and violent contraction of the abdominal muscles, by pressure on the testicle in the canal, is often a cause of most painful and severe inflammation. This may vary in degree from slight sensations of discomfort after severe muscular exertion or straining, up to frequent attacks of very severe pain, accompanied by swelling, extreme tenderness, nausea, and vomiting. These attacks may recur with such frequency as to completely incapacitate the individual for his work.

The following case illustrates the milder type of inflammation.

CASE 71.—A single man of twenty-four years, with left testicle retained in canal, where since puberty it had formed a small, tender tumor. For ten years had been subject to attacks of moderately severe pain on exertion, a source of great discomfort and annoyance. He said that the testicle was "much in the way, for it was continually getting hit." At operation it was found greatly atrophied and was removed.

The following gives a picture of a much severer type of inflammation, occurring in an uncomplicated case.

CASE 31.—A man, aged nineteen years, had a right partially descended testicle, situated in the pubic region, just outside the external ring. At the age of fifteen, he had a severe attack of pain in right testicle, accompanied by nausea, vomiting, and prostration. During the attack there was a tender tumor, size of fist, in right groin. Since then has had similar attacks three or four times a year, which have interfered greatly with his work. At operation, the testicle was found just outside the ring, considerably atrophied, but freely movable. It was sutured into the scrotum.

Inflammation of an undescended testicle sometimes occurs when the organ is forced into a different position; for example, where an abdominal testicle is made to enter the canal under pressure, or where one which has been retained in the canal is forced out of the ring on to the pubis. Under such conditions, orchitis is apt to occur, and persist until the organ is returned to its former position. A properly applied truss often relieves a patient who is subject to attacks of inflammation due to the above cause, for it prevents the testicle from assuming, under force or pressure, a new position.

The following report illustrates such a case.

CASE 18.—A man, twenty years of age, had his right testicle retained within the canal, associated with a right inguinal hernia of moderate size. This condition had existed as long as he could remember. The hernia had always been easily reducible, and the testicle had given him no trouble. He entered the hospital in January, 1895, with his hernia strangulated. This was reduced

under ether, but there was left a tender tumor, size of walnut, situated just outside the ring. For five days the testicle remained in this position, and was the seat of acute inflammation, at the end of which time it suddenly slipped into the canal, with almost immediate relief of all symptoms. He was given a truss and left the hospital.

In December, 1903, about nine years later, he reported that he had worn a truss most of the time; there had been no further trouble. Occasionally, when the truss was left off, the testicle emerged from the ring, causing slight pain and a feeling of weakness.

In the seventy-seven individuals recorded in the table, there were ninety-two undescended testicles, for fifteen had double arrest.

In thirty-four, there were no symptoms referable to the testicle. In thirty-two, there had been symptoms previously referable to the testicle. In twenty-six, there had been no symptoms until the time they came under observation.

PHYSIOLOGY.—During infancy and childhood, the testicle, whether normally or abnormally situated, probably plays no important part in the general development or bodily economy, but at the approach of the age of puberty, and from that period during the lifetime of the individual, the testicle assumes a new importance, special functions are given it which are retained during the whole or part of adult life, and its influence on the development and maintenance of function of the individual is worthy of consideration. At puberty, then, the testicle becomes associated with two distinct physiological processes, (first) the formation of spermatozoa within its tubules, and (second) an undoubted influence, manifest during early and late adult life, on the general development, growth, and bodily economy.

The impairment of function in the undescended testicle in respect to the first of these processes, that is, the production of spermatozoa, is a matter of considerable practical importance. An undescended testicle is almost invariably imperfectly developed, as regards size, consistency, and minute anatomy; and

it is agreed by all observers that such a testicle is incapable of the formation of spermatozoa, in a great majority of cases. This conclusion is based on the microscopic examination of such organs, as well as of the semen of double cryptorchids. Griffiths [14] has stated that there has never been an authentic case of spermatogenesis in an undescended testicle, but most authorities take a somewhat less positive view. The examination of several undescended organs removed at operation and the clinical history of a case (20) mentioned below show that the process of spermatogenesis is not only possible, but less uncommon than has been generally stated.

Three different views have been held regarding the frequent impairment of function of such testicles.

First. The retained testicle is imperfectly formed from the beginning, and its abnormality is a factor in its non-descent. (Hunter.) Second. The organ, although undescended, is normal until the age of puberty, and it then fails to develop. (Curling.) Third. The testicle, although undescended, becomes a perfect organ at puberty, but then, owing to its faulty position, it soon undergoes retrograde changes, resulting in partial or complete atrophy. (Monod and Arthaud.[15])

It is a fact that some testicles are imperfect in structure from the beginning, never developing after fœtal life or early infancy. Such organs are usually retained within the abdomen, and are always incapable of producing spermatozoa. It is also true that some testicles though undescended are of normal structure during childhood, but undergo none of the changes which are normal at puberty. It is not rare for a testicle which has been retained in its descent, but transplanted in youth to the scrotum by operation, to fail in its development at puberty, although its position then is natural. In other cases there is no doubt but that the malposition of the organ, for one cause or another, is directly responsible in preventing the proper development at puberty, and in the establishment of retrograde changes and atrophy. Griffiths,[14] in experiments performed on dogs, has shown that if normally descended testicles be

returned to the abdomen they become soft and small, and never show active spermatogenesis.

Still another view, which seems to be true in a certain number of cases, has been supported by Bellingham-Smith,[16] Monod and Arthaud, and others. They have stated that occasionally in undescended testicles the function of spermatogenesis is established for a time, but that it persists for only a brief interval of years, and then is lost. It is an undoubted fact that all double cryptorchids who have been reported to be the fathers of children have been very young men; their children having been born within the first few years after the establishment of puberty in the fathers. It has been stated that the function is never retained after the age of thirty.

The following case, No. 20 in the table, illustrates this point, as well as proving that not all double cryptorchids are sterile.

J. A. P. entered the hospital in July, 1895, at the age of fourteen. Since birth had noticed a small lump in each groin and absence of testicles in scrotum. The testicles, which were in the canals, occasionally descended to a high position in the scrotum, causing pain, which could be relieved by pushing them back inside the rings. Of late had had more frequent attacks, with greater difficulty in replacing organs. Examination showed considerable atrophy of the scrotum, and the testicles situated within the inguinal canals. An attempt was made at operation to bring the testicle outside the ring, but this was impossible, owing to shortness of the cord. The testicle was, therefore, pushed back into the abdominal cavity, and the canal closed, as in a Bassini operation. No operation was done on the right side.

At age of twenty patient was married, and became the father of a boy ten months later. Examination of patient, January 19, 1904, nine years after the first observation, showed complete atrophy of scrotum. The left testicle could be vaguely felt within the canal. It was soft and very small. On the right the testicle was very small, about one-eighth normal size, soft, and situated just outside external ring. The patient stated that he was leading an active sexual life, and considered himself normal in that respect. His wife had not been pregnant since the birth of the first child, four years before.

The above-mentioned individual, a double cryptorchid with very marked atrophy of both testicles, was unquestionably fertile at the age of twenty, but the subsequent history of his case suggests that the spermatogenetic function was not long retained. The following case, a man of the same age, also with double inguinal retention, but with very slight atrophy, was apparently sterile.

CASE 74.—Aged twenty years. Had always been aware of absence of testicles from scrotum, but had suffered no inconvenience until last two years. Of late, after prolonged standing or unusual exertion, had noticed painful lumps in both groins. Was wearing truss for relief of these symptoms. Examination showed both testicles to be situated in the canals, and fairly well developed, the right being slightly smaller than the left. Scrotum was atrophied. A careful microscopic examination of the semen failed to show the presence of spermatozoa.

Thus it can be seen that no rule can be applied to the spermatogenetic function of undescended testicles. In general, it may be stated that this function is absent in a majority of cases, but the proportion of those in which the organ is capable of the formation of spermatozoa is undoubtedly greater than has been supposed.

An individual with one testicle normally developed and situated in the scrotum is in no way affected as to bodily development and the power of procreation, although the other testicle may have been arrested in its descent. It is perhaps worthy of note that the normally placed organ shows no evidence of compensatory hypertrophy.

PATHOLOGY.—The histological appearances of undescended testicles vary within wide limits, and it is impossible to give any anatomical classification. In some cases there is very little, if any, change in the gross appearance of the organ, and even microscopically at first glance the section may appear normal, although on careful examination marked deviation from the properly descended adult organ can be found. In

other cases the testicle is at once recognized as being diseased and pathological. This variability is not constant with the position of the organ or the age of the patient, an inguinal testicle being sometimes more developed than one in the external ring, or an abdominal more than an inguinal. Two testicles from the same position in patients of the same age also may vary, and some parts of the organ may show marked change, while others, often closely adjacent parts, may be comparatively normal.

The changes occur in the albuginea, interstitial tissue, epithelium, and the basement membrane of the tubules, one or all of which structures may be involved.

The changes have been divided by Branca and Felizet [17] into two distinct groups,—those occurring before puberty and those taking place during adult life. In most cases there is probably little or no change till puberty, unless there has been some trauma; and it must always be borne in mind that no rule can be applied for the amount of this deviation from the normal. (Bezançon.[18]) In this series of cases unfortunately no specimens were removed before puberty, and the following brief description is based mainly on the findings of Branca and Felizet.

In children the change is essentially a fibrous one, and, in marked cases, is represented by the small atrophied testicle sometimes seen in later life, where the organ closely resembles a fibroma, no structures of the normal testicle being demonstrable even with the microscope. The albuginea in the less extreme cases is thickened, and usually two layers can be distinguished. The basement membrane of the tubules is thin, and in many cases cannot be distinguishd from the surrounding tissue, the reverse of which is true in the changes occurring in later life. The perilobular connective tissue is increased, making on section the lobules very prominent, and composed of cells of the embryonic variety, but approaching the adult type near the body of Highmore. Interstitial cells are rare instead of being present in comparatively large numbers, as is the case in the normal testicle before puberty. The epithelial

cells lining the tubules are usually of a uniform type, although in some specimens a slight differentiation can be distinguished. The vas and epididymis are, as a rule, normal.

In the Adult.—A testicle occupying a position in the base of the scrotum, or even in the groin, may vary in gross very little from one normally placed, but is usually flaccid and small. The epididymis may show some slight malformation, and is often separated from the testicle by a greatly lengthened mesorchium. The seminal vesicle on the affected side may be atrophied. (Launois.[19]) The vas is also usually normal, although tortuous, but will, when dissected out, allow the organ to assume its normal position. On section the tunica albuginea may be thickened, and the cut surface does not bulge in the manner characteristic of the normal gland, although the tubules may " string out" well. In the more fibrous specimens the increase of interlobular connective tissue is very marked.

Microscopically.—The tunica albuginea was more or less thickened in all of the specimens examined, in two being roughly five times as thick as that of the normal organ. The interlobular connective tissue varied greatly in amount, but was in all but one specimen (Case 77, Plate IV, Fig. 2) increased. In three cases (Cases 71, 72, 73, Plate IV, Fig. 1) the organ was composed in greater part of fibrous tissue, while in the remaining five (Cases 1, 44, 47, 52, 70, Plate IV, Fig. 3) the increase, although marked, was not as extreme. Plate III, Fig. 1, gives a good idea of the relative proportions of the tubular and fibrous tissue in a moderate case. The increase of the fibrous tissue was in two cases mainly interlobular, but in the others the lobules were not well marked and the intertubular tissues mainly affected. In Case 77 the proportion of the fibrous tissue to the tubules was approximately the same as in a normal organ, and with a low magnification it could not be distinguished from one. The fibrous tissue in all specimens was of the ordinary type, loose in the greater part of the organ, but becoming more dense near the body of Highmore.

Interstitial Cells.—One of the most striking features of undescended testicles is the so-called interstitial cell which

occur in all cases, and in some of the specimens examined were present in very large numbers. These cells are normally seen in small numbers in the testicles of children, but disappear about puberty, and are not found in the adult organ. In undescended testicle the reverse is true. Hansemann [26] reports that in the examination of many undescended testicles removed in childhood he rarely found them, while they were invariably present in specimens from the adult. As in this series of cases there were no specimens removed before puberty, it was impossible to verify the first part of this statement, but in all the sections the cells were present. What the function of these cells is in the economy is unknown. It has been suggested that they play an important part in the so-called internal secretion of the gland when active spermatogenesis does not take place. Although this is only theory, yet it is a well-known fact that patients with double retention and non-functionating organs have all the characteristics and desires of the male, which is not true if castration is performed. These cells occur in columns of varying size in the interstitial fibrous tissue between the tubules. According to Monod and Arthaud, they were more frequently seen around the blood-vessels, but in the specimens examined they had no definite relation to any structure of the organ, and were seen in all parts. In places they were in short, single columns, while in others they were in large masses, surrounding four or more widely separated tubules and completely filling the microscopic field. They are endothelial in type and of large size, with well-marked outlines. The nuclei are rounded, usually presenting well-marked nucleoli.

Two types can be distinguished, one with clear protoplasm, while in the other the protoplasm is finely granular, giving the cell a dark appearance and making a marked contrast between it and the surrounding loose, fibrous tissue. Still others contain pigment granules, and occasionally rod-shaped crystals.

Tubules.—Another marked deviation from the normal is seen in the basement membrane of the tubules, though it is not as striking a feature in most as are the interstitial cells. This

membrane was thickened in all cases, in some slightly, while in others the lumen was entirely obliterated and the tubule was only represented by a mass of dense, fibrous, and hyaline tissue. Two layers of the membrana propria could be distinguished: an outer fibrous one associated with the intertubular tissue, but distinct from it, which was thin and contained a few well-formed oval nuclei; and an inner hyaline layer. This inner layer was most characteristic and varied greatly in thickness, in many tubules completely obliterating the lumen, while in some specimens in a closely adjacent tubule the membrane was thin and active spermatogenesis was taking place. All grades between the two extremes could be found often in the same specimen and even in the same section (Plate II, Fig. 3). This inner layer consisted of an irregular hyaline-like membrane, often thrown into folds, usually showing no nuclei, although occasionally large, ill-defined, degenerated nuclei could be seen having well-marked nucleoli. This same thickening and hyaline change in the basement membrane can be seen in a much less degree in a senile testicle, and also may be caused experimentally in animals as a result of toxic irritation, but never in experimental stenosis of the vas. (Griffiths.[21])

Epithelium.—The epithelium lining the tubules showed in all cases examined a marked deviation from the normal. In those tubules where a thickened basement membrane had nearly obliterated the lumen there were no cells, or only a few degenerated ones of irregular shape and having indefinite outlines. In the less extreme cases the tubules were lined with a single, rarely double, layer of similar cells of rather large size, showing no mitoses. The protoplasm was granular in most, and in many showed vacuoles. The nuclei were oval and placed near the base of the cell. These cells probably represent the supporting cells of the testicle or cells of Sartoli. In the normal testicle before puberty the tubules are lined with epithelial cells of a single type. At puberty, however, these become differentiated into the supporting cells and the spermatogenetic cells. In the undescended organ in most of the tubules this differentiation does not take place, and the greater

number of cells remain as those of Sartoli, although some tubules often in close proximity to these or even to a completely obliterated one show some spermatogenetic cells. Spermatogonia and spermatocytes can be distinguished in many cases, but the process rarely goes on to completion; and it is in only a few tubules that perfectly formed spermatozoa can be found. In the examination of these nine specimens adult spermatozoa were found in four cases (Cases 44, 47, 52, 70), Case 70 being thirty years of age. One case (Case 71) showed on careful search a few tubules containing spermatogonia, while in the other four (Cases 1, 72, 73, 77) no differentiation could be made out, the epithelial cells being absent altogether or present as Sartoli cells.

Various forms of crystals are sometimes seen, the most discussed of which are the Reinke crystals described by Reinke [22] in 1896. These are fine needle-like crystals seen scattered through the interstitial fibrous tissue in almost every case, and their function has been variously interpreted. According to their discoverer, they play an important part in the formation of the testicle, while the majority regard them either as fœtal remains or products of degeneration.

The following is a brief description of the four specimens from which the plates have been made, illustrating the various types of testicles.

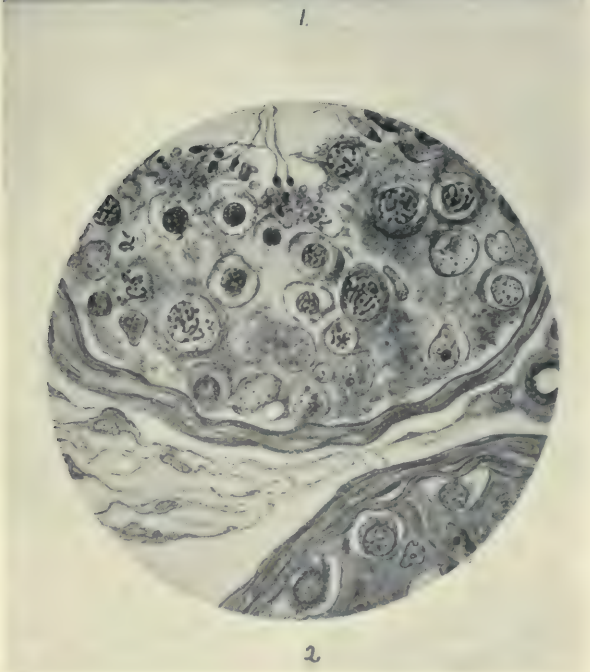
Case 47.—Aged sixteen years. High inguinal testicle. Plate I, Fig. 1. The testicle was two and one-half by two centimetres in diameter, and of normal shape, but of soft consistency. The vas and epididymis were normal and the mesorchium not marked. On section the albuginea was thickened, the lobules were well marked, and there was an increase of the fibrous tissue.

Microscopic examination showed the albuginea thickened and composed roughly of two layers, an outer one of dense fibrous tissue, and an inner one composed of loose tissue which merged into the interlobular fibrous tissue, and contained numerous small vessels. The interlobular fibrous tissue was increased, and contained many small oval nuclei, a few vessels, and some

PLATE I



1.



2.

FIG. 1.—Longitudinal section of the testicle from Case 47 magnified three diameters. This gives a very good idea of the relative proportion of the fibrous and tubular tissue in the average case, and also shows the thickening of the albuginea.

FIG. 2.—Normal testicle showing active spermatogenesis. The cells are seen in all stages from the spermatogonium to the adult spermatozoa. The supporting cells are best seen in the portion of the tubule at the lower part of the field. Zeiss Comp. Oc. 4. Objective, 2 millimetres. Oil immersion.

PLATE II.

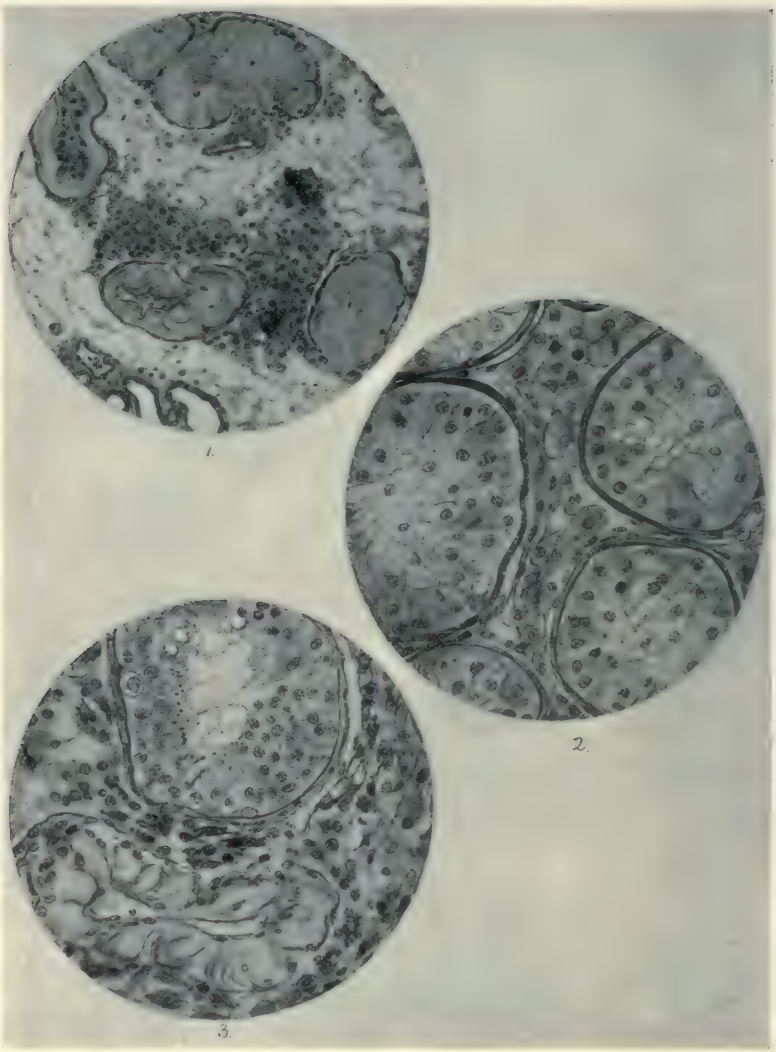


FIG. 1.—Section from Case 73. This shows the more advanced type. The tubules are for the most part represented by masses of hyaline tissue, and where the lumen is present it is filled by detritus and an occasional epithelial cell. The tubules are of irregular shape and widely separated by loose fibrous tissue containing large areas of interstitial cells. Zeiss Comp. Oc. 4. Objective, 8 millimetres.

FIG. 2.—Section from testicle of Case 77. There is no increase in the fibrous tissue, which, however, contains many small areas of interstitial cells. The basement membrane of the tubules is only slightly thickened, but they contain only supporting cells, no spermatogenetic cells being seen in any section. Zeiss Comp. Oc. 4. Objective, 4 millimetres.

FIG. 3.—Section from testicle of Case 70. The tubule in the upper part of the field shows some thickening of the basement membrane, but in the lower portion of it active spermatogenesis is taking place, although in the upper part none but supporting cells are seen. The tubule in the lower part of the field is nearly obliterated by the thickening of the basement membrane. The fibrous tissue is increased and contains many interstitial cells. Zeiss Comp. Oc. 4. Objective, 4 millimetres.

Reinke's crystals. Some of the lobules were more nearly normal than others, the least change being seen near the capsule. As a rule, the tubules were separated by a considerably increased amount of connective tissue containing many large areas of interstitial cells. The basement membrane of the tubules was thickened, and in most two layers could be distinguished, but in many the change was not marked. In some of the tubules there was no evidence of spermatogenesis; but, although Sartoli cells predominated, spermatocytes, spermatids, and in several fully developed spermatozoa were seen.

CASE 70.—Aged thirty years. Position inguinal. Plate II, Fig. 3. The testicle was three by one and one-half centimetres in diameter, soft, and had connected to it by a long mesorchium the epididymis and six centimetres of the vas. Portions of the parietal tunica were closely adherent to it in many places. On section the albuginea was thickened, and, although the lobules were not well marked, the tubules "strung out" well.

Microscopic examination showed the tubules widely separated by loose fibrous tissue, in which were masses of interstitial cells and Reinke's crystals. The tubules themselves showed a much thickened basement membrane, which was usually divided into a thin outer fibrous zone, and an inner one, thicker, of hyaline tissue containing no nuclei. The amount of this thickening varied greatly, being scarcely noticeable in some tubules, while in others it obliterated the lumen. Where the membrane was markedly thickened, the tubules were lined with a single very irregular layer of cells with oval nuclei and granular protoplasm, often containing vacuoles. In other places were tubules, which, although showing a somewhat thickened membrana propria, showed active spermatogenesis and contained adult spermatozoa. These normal tubules were seen singly and in groups, often being in close apposition to others showing complete obliteration.

CASE 73.—Aged twenty-nine years. Position pubic. Plate II, Fig. 1. The testicle was soft, two by one centimetre in diameter, and fastened to the wall of a hernial sac. It was separated from the epididymis, from which a tortuous vas eight centimetres long led off, by a long mesorchium. On section the albuginea was thickened and the organ noticeably fibrous.

Microscopic examination showed the albuginea much thickened. The greater part of the organ was composed of rather

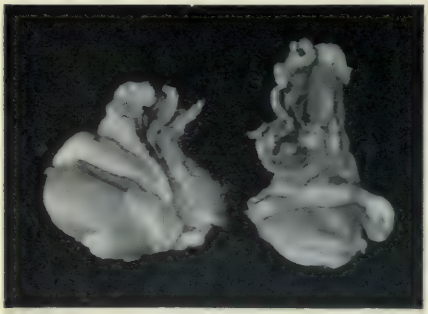
dense fibrous tissue, with many small oval nuclei, and containing large numbers of Reinke's crystals. There were also many interstitial cells, some in groups of three or four, others larger, occupying all of the field under high power. The tubules were scattered irregularly throughout the sections and had no definite arrangement. They presented a thick basement membrane in two layers, the outer being thin and fibrous, the inner thick, in many cases obliterating the lumen and giving the tubules the appearance of a solid hyaline mass. In some this process was not so advanced, and a few degenerated epithelial cells having no structure could be seen lining the tubules.

Case 77.—Aged twenty-three years. Inguinal testicle. Plate II, Fig. 2; Plate III, Figs. 2 and 3. The testicle was three by one and one-half centimetres in diameter and connected to the epididymis, which was imperfectly formed by a lengthened mesorchium. The cord was five centimetres long and not tortuous. On section the tunica was thickened, but otherwise the organ appeared normal.

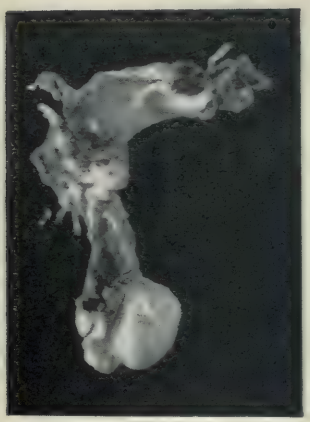
Microscopic examination showed no marked increase in the interstitial tissue, and the tubules, closely packed together and of normal size, giving the section the appearance, under the low power, of a normal organ. Under high power, the basement membrane was slightly thickened, and in the small amount of interstitial tissue were a few interstitial cells. The most marked change was in the tubular epithelium. This was represented by irregularly placed rounded or oval nuclei lying in faintly-staining granular protoplasm often containing vacuoles. In no tubule was there any evidence of spermatogenesis, and all appeared to be in about the same stage of development.

Complications.—The inflammatory conditions to which the undescended testicle is especially liable have been discussed under symptomatology. There are other forms of acute and chronic inflammations, due either to extension of morbid processes from the urethra, or to constitutional disease. Attacks of simple inflammation, if oft repeated, frequently result in marked atrophy of the testicular substance, the organ becoming a mass of fibrous tissue. An arrested testicle, even if atrophied, is liable to gonorrhœal infection from the urethra.

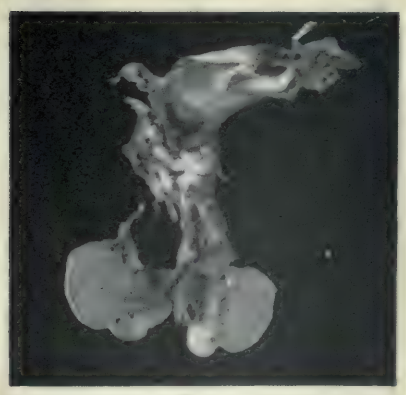
PLATE III.



1.



2.



3.

FIG. 1.—Photograph of testicles from Case 1 removed at autopsy, showing the difference in size of the normal and undescended organ. The lengthened mesorchium and tortuous cord can also be seen.

FIGS. 2 and 3.—Photographs of the testicle from Case 77. At the upper part of the specimen the remains of the hernial sac is seen. The cord is tortuous and the mesorchium somewhat lengthened.

CASE 52.—Twenty years of age. Left inguinal retention. Two days before entrance to hospital, during an attack of gonorrhœa, first noticed pain in left groin, with tender lump. No vomiting. At operation, a small atrophied testicle, acutely inflamed, and surrounded by considerable porky inflammatory tissue, was removed from the canal.

Pathological examination (abstract of report of Dr. J. H. Wright). On section the epididymis was dark red in color, and showed many grayish tubules filled with purulent material. Smears of this stained by Gram's method showed intra- and extracellular Gram-decolorizing diplococci. Cultures on hydrocele agar showed pearly-white colonies, the largest two millimetres in diameter in forty-eight hours, of Gram-decolorizing diplococci. Cultures on plain agar showed no growth. Microscopic examination showed the larger tubules filled with pus, while the smaller ones were comparatively normal. In some tubules the epithelium was absent, and there were purulent infiltration and disintegration of the surrounding tissues. In many of the cells diplococci like gonococci were present. The interstitial tissue showed marked infiltration with fibrin and leucocytes and other inflammatory cells. The vessels were dilated. The vas showed loss of epithelium and contained pus-cells. There was some infiltration of the cord with inflammatory exudate.

Parotitis has been mentioned as a cause of acute inflammation in undescended testicles. In this series, Case 20 was observed during an attack of mumps, which appeared one week after operation on the testicle, but there was no sympathetic inflammation of either organ. Chronic inflammatory conditions are seen when the testicle is the seat of tubercular or, more rarely, syphilitic infection.

CASE 6.—Aged twenty-two years. 1888. Right inguinal retention. One year ago had gonorrhœa and acute epididymitis, followed by swelling in right groin, from which a discharging sinus resulted. At operation, a considerably enlarged testicle was removed from right inguinal canal. Pathological examination showed the testicle and epididymis to be considerably enlarged. On section, in the globus minor were many large pus cavities and cheesy areas separated by fibrous tissue. There were also several small cheesy areas in the testicular substance.

HERNIA.—Inguinal hernia is by far the commonest complication of undescended testicle. The symptoms which it produces are very apt to be the cause of a patient's seeking treatment when, perhaps, his attention is called for the first time to the misplaced organ.

In this series of ninety-two cases, there was some form of hernia in forty-nine, *i.e.*, about 57 per cent. Corner [23] has stated that a hernial sac is to be found in 70 per cent. of the cases. In 49,859 hernias observed at the Hospital for Ruptured and Crippled from 1891–1902, there were 400 cases associated with undescended testicle. The patients ranged in age from four to thirty years. (Coley.[24]) Eccles, in 48,000 cases of hernia in the male, found 854 imperfectly descended organs.

It is easy to see why hernia so frequently accompanies this deformity, for the processus vaginalis is seldom obliterated, and its descent into the scrotum precedes that of the testicle, being independent of it. Thus, a hernial sac is formed. In inguinal retention the mechanical dilatation of the canal, due to the presence of the testicle, is a predisposing factor. Sometimes, however, the processus is normally obliterated, and the testicle is formed in a separate sac from that of the inguinal hernia. In this series, thirty were recorded as simple inguinal hernia, eighteen as congenital. It is probable that a more careful recording of many of the cases would have shown a larger proportion of the congenital variety.

Inguinal hernia is unquestionably more apt to become strangulated when associated with an arrested testicle. It occurred in ten of the forty-nine cases mentioned above. Sometimes the testicle seems to act as a ball-valve, by slipping into the canal, and thus holding the gut fast in the scrotum.

CASE 65.—Aged twenty-seven years. Right inguinal retention. Had occasionally felt a small tender mass in groin. Entered hospital with large tumor in groin and scrotum; duration, twenty-four hours; marked constitutional symptoms. At operation the scrotum contained a mass of injected bowel and much clear fluid. An atrophied testicle, situated just inside the ring, in the same

sac, was apparently the main factor in preventing the return of the bowel. Testicle was sutured in scrotum and the gut returned.

Rare cases have been reported of monocryptorchids who have had hernia on the opposite side, suggesting the possibility of a defect in the muscular apparatus in the inguinal region. It seems more reasonable to regard them as mere coincidences. In Case 24, in the table, the hernia on the opposite side did not make its appearance until the patient was forty-two years old, and might easily be accounted for by the nature of his work.

Interstitial Hernia.—In this form of inguinal hernia, the sac is forced between the abdominal muscles or between the external oblique muscle and its fascia. It is comparatively rare, but in the male is nearly always associated with some form of cryptorchidism. It occurs in cases where the testicle, perhaps undersized and undeveloped, is situated low in the canal or just at the ring. A hernial protrusion, caused by increased pressure in the abdomen, finds there an obstruction to its course through the ring, and its sac is forced out from the canal between the layers of the abdominal wall, where resistance is less. In this way a large hernial sac may be developed. The hernia is most often found between the fascia covering the external oblique and the muscle itself or its aponeurosis; but it may be found between any two adjacent layers of the abdominal wall.

Case 56.—Twelve years of age. Left testicle had never descended. Had noticed lump in left groin for four or five years; disappeared on lying down. Three days before admission to hospital, a tumor appeared in groin which was irreducible. Examination showed a tense, tender mass, size of lemon, above Poupart's ligament. Impulse on coughing. At operation, the hernial sac was found to be above the ring, between the external oblique and its fascia. It contained the testicle in a congenital sac, with inflamed omentum and some fluid.

In rare cases an interstitial sac may be caused by an ectopic testicle, which carries with it the open processus vagi-

nalis. (Moschcowitz.[25]) In the same manner, an ectopic testicle situated in the perineum may cause a hernia there.

Hydrocele.—If the funicular process is obliterated, simple hydrocele may occur. Such a condition might easily lead to errors in diagnosis of tumors in the groin. The commonest form is congenital hydrocele, when the open processus allows the exit of fluid from the abdominal cavity, but into which neither bowel nor omentum has protruded.

Torsion of the Spermatic Cord.—Gangrene of the testicle due to twisting of its spermatic cord is of rare occurrence, but as statistics show that in about one-half the cases the testicle is undescended, the condition is worthy of brief consideration. In 47 per cent. of the cases collected by Scudder,[26] the testicle was undescended. The precise cause of a rotation of the testicle on its axis is not definitely understood, but in all reported cases some abnormality of the organ has been noted. In fœtal life the blood supply comes through a mesenteric fold of peritoneum, the mesorchium, derived from the Wolffian body. The mesentery disappears during the descent of the testicle, and in adult life is represented by that part of the organ uncovered by the tunica vaginalis, where the vessels of the cord enter it.

A persistence of the mesorchium as a true mesentery is one of the causes of non-descent of the testicle, for it hinders the organ from being properly engaged at the internal ring. In most carefully reported cases of torsion, a long mesorchium was found, with a testicle freely movable within its tunica, and its persistence is undoubtedly an etiological factor of importance in torsion. Cabot[27] has reported a case of gangrene due to torsion in which the mesorchium was very short, and tightly wrapped around the twisted cord. Rotation results in shutting off, more or less completely, the blood supply, giving rise to hæmorrhagic infarction and interlobular hæmorrhage with subsequent fibrous change, or to gangrene.

In some instances, acute hæmorrhagic infarction, followed by gangrene, occurs where no twist in the cord has apparently been present. Such cases have been reported by

Volkmann (1877) and English, as cited by Scudder, and the following may be classified under this heading.

Case 33.—Aged twenty-one years; single. Right testicle in inguinal canal. For the last three or four years had occasional attacks of pain in right groin with swelling of the arrested organ. Examination showed in the right groin a tense, semifluctuant tumor, size of hen's egg, painful and tender. Impulse on coughing. At operation, testicle found in canal, much increased in size, of purple color. Behind it was a hernial sac filled with clear fluid. There was no twist in the cord. Orchidectomy. The testicle was large and fibrous; and on section there was noted a considerable amount of hæmorrhage in the interstitial tissue. No evidence of spermatogenesis.

Torsion of the cord occurs in the majority of cases in early adult life, and usually follows some excessive muscular exertion or injury in that region. It is noted that the symptoms have frequently appeared immediately following coitus. The symptoms are of sudden onset, often simulating strangulated hernia, but with less constitutional disturbance. Operative interference is always indicated, and orchidectomy is usually necessary. In the cases collected by Scudder there was no mortality.

Case 23.—Aged twenty-seven years; single; a double cryptorchid. For many years had worn a truss for left inguinal hernia. Four days before admission to hospital, the hernia had become irreducible. There was much pain and tenderness, with nausea and some constitutional disturbance. The scrotum was atrophied; right testicle could not be felt. In left inguinal region was a hard, tender tumor the size of a lemon. At operation, a gangrenous testicle was found in the canal, lying in a congenital sac, which also contained a piece of gangrenous omentum. There were two complete twists in the cord. The testicle and omentum were removed.

The question of the blood supply of the testicle is one of considerable interest, as it has an important bearing on

the surgical treatment in many cases. Much experimental work has been done. It is often found, in attempting to transplant an undescended testicle to the base of the scrotum, that the cord is too short. In such cases, the vessels are usually of insufficient length to allow of any lengthening of the cord by traction, while the vas is somewhat tortuous and offers no difficulties to a successful orchidopexy.

The question arises as to whether the vessels can be, in such emergency, divided without serious injury to the testicle. This has been occasionally done by surgeons without other damage than marked atrophy of the organ. After division of the vessels, the vas has been found to be long enough to permit of transplantation of the testicle. A certain amount of stretching incurs no risk.

Mifflet,[28] in operations on dogs, arrived at the following conclusions: that obliteration of the spermatic artery was always followed by hæmorrhagic infarction of the testicle, and that obliteration of the veins alone was sufficient to cause a degeneration of the testicular substance. Griffiths,[29] in a later series of similar experiments, concludes that after ligation of the spermatic artery there is an immediate diminution in size of the organ and fatty degeneration; later, in rare cases, a portion of the testicle may resume its function. Ligation of the veins leads to great engorgement, followed by gangrene or atrophy. Ligation of both veins and artery leads in most cases to complete wasting. After any of the three procedures, any of the above results may occur.

Torsion of the cord, therefore, may occur without gangrene of the testicle. In fact, it is fair to suppose that mild attacks of orchitis are frequently due to torsion of the cord, in which the blood supply is not seriously impaired.

Malignant Disease.—In a study of the undescended testicle, the question of its liability to become the seat of malignant disease is of great importance.

Thiriar[10] (1887) stated that an arrested testicle was a source of great danger to its possessor, on account of the probability of sarcomatous degeneration. The same opinion

has been held by most authorities on the subject for a century, the early writers being impressed by the frequency of tumor formation. Arnott, in 1848, mentions seven cases; Fischer,[30] in 1864, collected thirty-nine cases, and Scymanowski,[31] Kocher, Spry, Godard, Gowers, Johnson, and von Kahlden[32] have contributed to its literature. Kronpecher[33] mentioned two cases of sarcoma of both testicles in double cryptorchids, and believed that incomplete descent furnished a strong predisposition. Eccles, on the other hand, from a study of a great number of cases, has recently concluded that no sufficient proof exists for the belief that sarcoma is of more frequent occurrence in imperfectly descended testicles.

In a series of fifty-four cases of malignant disease of the testicle, at the Massachusetts General Hospital, during a period of twenty-six years, six cases were in arrested testicles, *i.e.*, 11 per cent. Schädel, quoted by von Kahlden, reported that in a large London hospital, in one year, forty-one cases of malignant disease were seen, five of which were in undescended testicles, *i.e.*, 12 per cent.

These figures tend to sustain the opinion of the older authorities; and it seems reasonable to believe that sarcoma is of somewhat more frequent occurrence in the ill-developed and abnormally placed testicle. The cause of such predisposition is not clear. Trauma has been suggested, but, as the disease often occurs in cases of abdominal retention, its effects would not seem to be important. It is extremely rare in children; the average age of the six patients reported in the foregoing table was forty years. It is most often noted in inguinal testicles, but is almost as frequently seen in those which have been retained in the abdomen. In the six cases in this table (one double retention), four were inguinal, three were abdominal.

These tumors may attain enormous size. Johnson reported an autopsy where a tumor of the right testicle occupied most of the abdominal cavity, displacing the viscera. The disease is almost invariably fatal, and death usually occurs within a year after the appearance of symptoms. Five of the

six cases reported died within a year. The remaining case lived three years.

It is said that any form of sarcoma may occur. Hansemann has laid stress on the endothelial type, which, he believed, originated in the interstitial cells. Benenati [34] reported a case of rhabdosarcoma of the testicle.

Metastases occur, as a rule, early in the course of the disease. Metastatic growths in the spinal cord are common.

A brief pathological description, based on reports of Dr. W. F. Whitney, of four of the cases in the table is as follows:

Case 26.—Specimen consisted of an oval growth, thirteen centimetres in diameter, covered with a dense, smooth capsule. On section the tumor was composed of soft, grayish-white tissue, opaque, and divided into lobules by dense bands of fibrous tissue. Many large, soft, necrotic areas and several hæmorrhagic cysts. Microscopic examination showed solid masses of large rounded cells, with round nuclei, and a considerable amount of clear protoplasm. The nests of cells were separated by a comparatively small amount of loose fibrous tissue. Large round-celled sarcoma of endothelial type.

Case 28.—Plate IV, Fig. 1. An oval tumor, fifteen by ten centimetres in diameter, resembling a testicle in shape, one portion representing the body of the testicle, covered by a dense, smooth, fibrous capsule, in which were many vessels. On one side corresponding to the epididymis was an opaque, grayish-white lobulated growth. On section, the centre of the tumor consisted of soft, hæmorrhagic, necrotic tissue, while the periphery was slightly denser, homogeneous, and gray in color. The mass had a thin elongated attachment which might be likened to a cord, but which contained nothing corresponding to the vas deferens. Microscopic examination showed growth to be composed of large round cells, many of which were multinuclear, with a little granular intercellular substance. No normal testicular tissue found. Round-celled sarcoma.

Case 36.—At autopsy the left testicle was normal and the vas led normally to the seminal vesicle. The right testicle was not present, but in the right iliac fossa extending to the median line was a tumor mass covered by peritoneum and resting on the

PLATE IV.

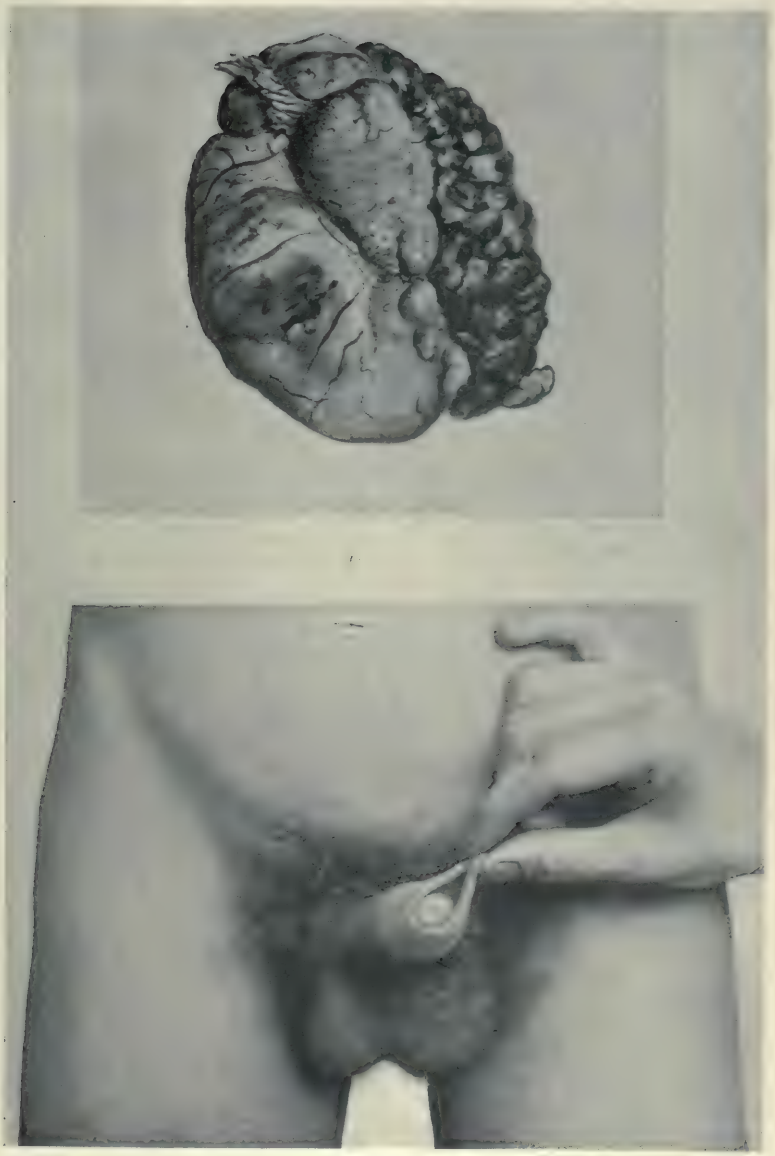


FIG. 1.—Sarcoma of the testicle from Case 28. The cord may be seen at the upper portion of the specimen

FIG. 2.—Photograph of Case 30. Taken four years after double orchidopexy. Shows unusually good result.

muscles which it infiltrated in places. The growth had pushed up between the folds of mesentery and displaced the ureter. It had also infiltrated the wall of the ileum for twelve centimetres above the ileocæcal valve, and was only separated from the lumen of the gut by a thin layer of mucous membrane. From this growth the vas led to a normal seminal vesicle. On section the tumor was extremely soft and extensively necrotic. Around the periphery it was grayish and homogeneous.

Microscopic examination showed masses of large round cells of varying size, separated by considerable intercellular substance, in which were spaces for the passage of blood without distinct walls. Here and there were bundles of smooth muscular fibres probably associated with some of the vascular trunks. The growth was roughly divided into lobules by dense bands of fibrous tissue. In no section was there any normal structure of the testicle. The vas was surrounded by tumor growth. Many of the cells showed mitotic figures. There were metastatic nodules in the portal vein and in a section of the liver. Round-celled sarcoma.

Case 64.—Body of testicle was transformed into a tumor mass, nine centimetres in diameter, which on section was soft and opaque, and with a marked tendency to hæmorrhagic necrosis. Along the edge was a narrow zone of firmer grayish tissue, and in the connective tissue was a similar growth, in the midst of which were bright yellow necrotic areas.

Microscopic examination showed large round cells, separated by fibrillar intercellular substance, uniting with connective tissue. There was such extensive necrosis that only in a few areas could a cellular condition be made out. No normal structure of the testicle was found. No tumor growth detected at upper end of the cord. Large round-celled sarcoma.

Treatment.—The treatment of undescended testicle varies according to the age of the patient, the presence or absence of complications, and the severity of symptoms in a given case. A consideration of the age of the patient is of the utmost importance, for the treatment is essentially different in infancy, youth, and adult life.

Uncomplicated Cases without Symptoms.—As has been

shown, it is not unusual for infants at birth, and for some time thereafter, to have partially descended testicles on one or both sides. This condition is of no special importance, for the chances are very great that the organ will descend to the scrotum during the first few months. The failure of descent in no way affects the health, vitality, or development of the infant at this age, and no treatment with a view to correcting the deformity is of avail. The condition should be noted, nothing more.

During childhood the failure of descent of the testicle assumes greater importance, for the longer the condition persists, the smaller becomes the chance of its descending spontaneously. Nevertheless, until a late period in childhood is reached, the condition is of no greater importance than in infancy, except for the above reason. Children with one or even both testicles imperfectly descended, up to the age of ten or eleven years, show no abnormality referable to the defect. If, however, a child reaches the age of eleven or twelve, and the undescended organ still shows no tendency to progress to the scrotum, the condition should be regarded in a different light. The chance of its descending after this age is very small; also the age of puberty is approaching, at which time the testicle is to assume new functions, unless prevented from so doing by a faulty position. The period of childhood from eleven or twelve years to puberty is of great importance, for it is during this period that operations for transplanting the testicle to the scrotum are most frequently attended with good results, both as regards the ultimate location of the organ and its integrity.

In many of these cases the testicle by manipulation can be withdrawn from the canal and placed in the scrotum. If this is possible, gentle massage and traction should be tried daily, and in some cases such measures have apparently aided the testicle in its descent.

If a testicle is allowed to remain in an abnormal position during the period of puberty, there is good reason to believe that it will not undergo the changes incident to puberty, and

will probably remain functionless. It is rare for a surgeon to be called to treat an adult with undescended testicle with which there are no complications or symptoms caused by the deformity. The condition is usually noted and advice sought by the parents during childhood.

Uncomplicated Cases with Symptoms referable to the Testicle.—It is unusual for children under ten years of age to suffer from attacks of pain in the region of the misplaced organ unless there is a history of direct trauma. The testicle is small, usually freely movable, and lacks much of the peculiar testicular sensitiveness of later life. Operative treatment is rarely called for at this age for the relief of symptoms, unless the attacks of pain and swelling are severe, and are liable to impair the function of the testicle. Towards puberty the organ becomes more sensitive and there is a greater liability to pain. In adult life, pain and inflammation are of commoner occurrence, and relief by surgical treatment is often sought. It becomes then a question of the choice of operative procedure, the results of which are discussed later.

Cases with Complications.—By far the commonest is some form of hernia. If this exists, operation is to be advised considerably earlier in life than in simple cases. (Tuffier.) Operation consists in locating the testicle and treating it according to the existing condition as in uncomplicated cases, and in performing a radical cure of hernia. The treatment in cases with which other complications than hernia are associated has been described.

No child with double undescended testicle should be allowed to reach the age of puberty without an effort being made by operation to bring the organs to their normal position, for if the deformity is disregarded the individual will probably be sterile throughout life. It has been claimed that double arrest of the testicle is liable to interfere with the normal development at puberty, but it seems as if this rarely, if ever, occurs. Such influence as the testicles exert at puberty on the bodily development is probably not modified by the position of the organs. Although the function of spermatogenesis may

not be established, yet that other physiological influence, claimed by many to be due to an internal secretion of the gland, is present.

If the deformity is single, although good surgery demands an attempt at its correction being made, the importance of such a procedure is lessened, for the individual can maintain all functions with a single properly descended testicle. In operations on children, both organs should not be placed in the abdominal cavity, for such testicles are invariably functionless; and in no case, single or double in children, should orchidectomy be done, unless the testicle is hopelessly degenerated. In adults, with double arrest, if an attempt at orchidopexy is unsuccessful, the organs may be returned to the abdominal cavity. Orchidectomy should be done only as a last resort, and castration is never justifiable. No treatment is to be advised for abdominal retention.

The operations may be divided into three groups: (1) Orchidectomy; (2) Orchidopexy; (3) Replacement in abdomen. The choice is in all cases governed by the age of the patient and the condition and position of the organ as found at operation. If there is marked atrophy, and the other testicle is unquestionably normal in every respect, orchidectomy is the operation of choice, especially if there is a complicating hernia, for the testicle is functionless, and the removal of the cord makes it easier to close the canal, and thus prevent a recurrence of the hernia. Orchidopexy is the operation of choice in children; and in adults attempts should be made in most cases to lower the position of the testicle before orchidectomy or other measures are resorted to.

Technique.—The inguinal canal is opened, as in the Bassini operation for hernia, thus exposing the testicle and spermatic cord. The cord is dissected free, and considerable traction exerted on it without incurring any danger. If little or nothing is gained by this procedure the vas should be dissected free. It is usually found to be very tortuous, and may extend in a loop below the testicle itself. The shortness of the cord is seldom due to the vas, but rather to the blood-vessels

which accompany it. Some operators advise a division of all but the vas, which allows the testicle to be brought to the scrotum with ease; in these cases the artery of the vas probably supplies the testicle through its anastomoses. This seems to be an unwarrantably radical proceeding, and while it has undoubtedly been successful in some cases, yet it is a well-known fact that in operations for varicocele, when only a part of the vessels are divided, gangrene of the testicle may supervene. The experiments on the blood-vessels, cited above, are of interest in this connection. If, as is rarely the case, the vas is that portion of the cord which prevents its being lengthened, the epididymis may be partially dissected free from the testicle, and the organ inverted.

If there has been a failure of closure of the processus vaginalis, and a congenital sac exists, the sac should be divided, its upper portion being disposed of by suture of the neck and excision, while its lower portion can be folded and stitched around the testicle, making a tunica vaginalis. The canal is closed as in the Bassini operation, the cord being fixed at the external ring by a stitch which fastens it to the aponeurosis of the external oblique. This stitch should be placed while traction is maintained on the cord. (Tuffier.[35])

As the side of the scrotum corresponding to the undescended testicle has never been distended, it should be filled out with a mass of gauze early in the operation, which puts it on the stretch and forms a cavity for the reception of the testicle.

The testicle is held in the scrotum by suture of the tunica albuginea to the subcutaneous tissue of the scrotum, or it may be allowed to lie in its position without suture, held in place by a suitable bandage. Even when the greatest care is taken to anchor the organ at the base of the scrotum, there is almost invariably a marked tendency to retraction upward. The scrotum, especially if undeveloped, exerts little influence in holding the testicle down. This retraction may be apparent soon after the operation, or may be slow in making its appearance, the testicle gradually working its way upward for months after its transplantation.

An operation has been described by Katzenstein [36] in which the testicle is withdrawn from an opening in the base of the atrophied scrotum and sutured to the inner side of a pedunculated flap of skin dissected up from the inner side of the thigh. This flap is later cut off and made to form a new base to the scrotum.

When, in adults, orchidopexy is found to be impossible, and it is deemed best not to remove the testicle, it may be replaced in the abdominal cavity, and the canal closed tight by suture. This procedure renders the organ functionless, and is liable to be followed by a recurrence of the trouble, for the testicle may find its way again, after the lapse of some time, into the inguinal canal. (Case 20.)

Results of Operation.—In considering the value of the operation as to end results, attention should be paid to the ultimate position of the testicle, its size, and probable functionating powers, and the relief or aggravation of symptoms. No attempt has been made to tabulate the end results in cases treated by orchidectomy.

Orchidopexy.—If the aim of the surgeon is merely to draw down the testicle sufficiently to fix it outside the external ring, his effort is almost invariably attended with success. Most testicles, lying in the canal, can be brought down by traction or otherwise into such a position. This allows a tight closure of the canal, and thus prevents the likelihood of a recurrence of a complicating hernia. Many believe that the testicle should be spared even if much atrophied, on account of its supposed value in the economy. On the other hand, many operators are not satisfied with such a result, believing that an organ so placed is in a position likely to cause much discomfort, and, being undoubtedly functionless, is much better removed.

Brocha [37] operated on 138 cases. Seventy-nine were followed for one year; thirty-one of these were normal in size and position; thirty-five were normal in size, but situated high in the scrotum; thirteen were atrophied. All of these cases, however, were in young children; and Keyes,[38] commenting on the series, says that no such results could have been obtained in adults.

Coley operated on thirty-eight patients, of whom twenty-seven were children, and all were under thirty years of age. In only two of these cases did he find it best to remove the testicle.

Tuffier [39] reported a series of twenty-five cases in which orchidopexy was done in twenty-three. The end result is not known.

The literature abounds in reports of single cases in which orchidopexy was satisfactorily performed; but the end result of such cases is difficult to ascertain.

In the following table, there were twenty-four orchidopexies done on twenty-two patients, two having double retention. The end result in eighteen of these cases is known. Seven of these were under fourteen years of age.

DETAILED RESULTS OF ORCHIDOPEXIES.

Case 11.—1893. Aged twenty years. Right testicle at internal ring; inguinal hernia; pain for several years. Sutured into scrotum, the cremaster being divided and globus minor dissected off testicle. Bassini for hernia. Eleven years later, organ much atrophied in extreme upper part of scrotum. Until two years ago had much pain. No recurrence of hernia.

Case 16.—1894. Aged five years. Right inguinal retention. Symptoms for three weeks following trauma. Sutured in scrotum with fine silk. Inguinal hernia, not congenital; Bassini operation. Ten years later, testicle vaguely felt in canal, very much atrophied. Scrotum atrophied. No symptoms; no recurrence of hernia.

Case 24.—1897. Aged forty-two years. Left inguinal retention; right inguinal hernia; pain on left side after exertion. Testicle sutured in scrotum; Bassini on right. Six and one-half years later, left testicle situated one and one-half inches below external ring, in scrotum. Very much atrophied, about one-sixth normal size. No symptoms.

Case 30.—(See Plate IV, Fig. 2.) 1899. Aged thirteen years. Left testicle felt over external ring, normal in size. Right testicle not felt (abdominal). Scrotum atrophied. No symptoms. Left testicle freed and sutured in scrotum. One year

later, left testicle in scrotum. Right testicle felt under skin above external ring. Dull pain in right groin for six months. Right testicle found subcutaneous, easily sutured into scrotum. Open processus vaginalis, closed; Bassini.

Four years after second operation, left testicle normal in size and position, freely movable; congenital hydrocele present. Right testicle normal in size and position, freely movable. Scrotum and penis well developed. No symptoms.

CASE 32.—1899. Aged eleven years. Left inguinal retention with inguinal hernia. No symptoms. Testicle sutured in scrotum. Bassini.

Four years later, testicle much atrophied, immovable at external ring, very tender, and frequently inflamed. Scrotum atrophied. No recurrence of hernia.

CASE 37.—1900. Aged twenty-six years. Double inguinal retention and double inguinal hernia. Pain, most noticeable on right side. Both testicles found small and atrophied, but sutured into scrotum with difficulty, owing to shortness of the cords; Bassini. Three weeks later both testicles retracted into the external rings. Three and one-half years later both testicles felt in canals, very small. Scrotum atrophied. No recurrence of hernia. Patient strong and athletic; has normal intercourse. Unmarried.

CASE 49.—1901. Aged sixteen years. Right inguinal retention. Pain for a few months. Testicle sutured into scrotum. Two and one-half years later testicle about one-fifth normal size, very high in scrotum. No symptoms.

CASE 50.—1901. Aged twenty-one years. Left inguinal retention with inguinal hernia. Attacks of pain and swelling for ten years. Testicle sutured to base of scrotum, the spermatic vessels being divided; Bassini. Two and one-half years later testicle about one-half normal size in upper part of scrotum. No symptoms; no recurrence of hernia.

CASE 55.—1901. Aged twenty years. Left inguinal retention. Painful swelling for three months. Testicle sutured in scrotum without difficulty. At end of operation it was one and one-half inches below external ring. Two years later testicle one-half normal size, situated slightly higher than right, in fair position. Organ causes much pain, due to frequent injury.

CASE 60.—1902. Aged twenty-four years. Left inguinal retention with congenital hernia. No symptoms. At operation

testicle appeared normal, sutured in scrotum; Bassini. Thirteen months later testicle retracted to pubes. Has some pain. No return of hernia.

CASE 62.—1902. Aged nineteen years. Right testicle at external ring. Inguinal hernia. Attacks of pain for two years. Testicle found normal in size, in congenital sac. Cord short. Sutured with difficulty in scrotum. Three weeks later, retracted to level of root of penis. Thirteen months later, testicle in canal, much atrophied, causing pain most of the time. Scrotum on right entirely atrophied. No return of hernia.

CASE 63.—1903. Aged thirteen years. Left inguinal retention with congenital hernia. No symptoms. Sutured in scrotum; Bassini. One year later, testicle situated high in scrotum; no symptoms; no return of hernia.

CASE 66.—1903. Aged twenty-eight years. Right inguinal retention and congenital hydrocele. Pain in groin. Testicle sutured in scrotum; Bassini. Nine months later, testicle one-fifth normal size, just outside external ring. Pain continues. Scrotum atrophied. No return of hernia. Sexual neurasthenic.

CASE 68.—1903. Aged thirteen years. Right inguinal retention with congenital hydrocele sac. Attacks of severe pain for two years. Sutured into scrotum. Three weeks later was one inch below ring. Nine months later testicle in extreme upper part of scrotum. Slight pain at times.

CASE 69.—1903. Aged five years. Right inguinal retention with inguinal hernia. Considerable pain at times. Sutured in scrotum; Bassini. Nine months later, testicle just outside ring; no return of hernia; no pain.

CASE 75.—1903. Aged twenty-two years. Double inguinal retention with strangulated hernia on left side. Symptoms due to hernia. Bowel returned to abdomen; Bassini. Left testicle very small, held just outside ring by close suture of external oblique aponeurosis. Three weeks later, testicle in same position; no symptoms.

SUMMARY.—Orchidopexy was performed seven times in children ranging in age from five to thirteen years. In but two instances was a perfect result obtained, and this in the same patient, aged thirteen, who had double retention. Both testicles are normal in size, position, and probably in function-

ating power. Two other boys were operated on at the same age, thirteen; and in both the testicles have remained in the scrotum. Although they have retracted to a position high in the scrotum, they are not in contact with the pubic bone. Neither testicle is notably atrophied. One of the patients suffers some pain. One case, aged eleven, has a poor result, the testicle being much atrophied and fixed firmly just outside the ring, where it is a constant source of pain, and would better be removed. Two children were five years old at operation. In one the testicle drew up into the canal, where it remains, very small and undeveloped; in the other, it retracted to the pubic region, where it has, as yet, given no trouble. The only really satisfactory results were in the four cases aged thirteen.

As a result of the eleven operations performed in adults from sixteen to forty-two years of age, five testicles have remained in the scrotum, four of them occupying a high position in it, while the remaining one is in almost perfect position, and fully one-half normal size, yet is the seat of frequent inflammatory attacks due to injury. Three testicles retracted soon after operation into the canals, where they remain, very much atrophied. One of them is the cause of much pain. Two have retracted to the pubic region, where they are the source of considerable annoyance, undoubtedly due to their position. One of these is atrophied.

In every case in which the organ appeared normal at the time of operation, there has been a subsequent diminution in size: in two cases, however, the atrophy is not very marked, the testicle being fully one-half normal size.

In two cases symptoms were distinctly relieved, in three not relieved, and in two others were aggravated.

In no case has there been a recurrence of a complicating hernia.

RESULTS OF CASES IN WHICH TESTICLE WAS REPLACED IN THE ABDOMINAL CAVITY.

Case 20.—1895. Aged fourteen years. Double inguinal retention. Painful tumor in each groin. At operation, left testicle was placed in abdomen, as cord was very short.

Examination eight years later. Left testicle vaguely felt in canal. Right testicle, very small, situated at external ring. Wears truss, as much pain results if testicles are allowed to emerge from the rings. Patient is married and has one child.

CASE 39.—1900. Aged nine years. Left inguinal retention with congenital hernial sac. Pain for a year following trauma. Testicle placed in abdomen. Three and one-half years later, left side of scrotum atrophied. No symptoms; no return of hernia. Testicle not felt. Testicular sense on deep pressure in left iliac region.

CASE 43.—1900. Aged twenty-one years. Left inguinal retention with congenital hernial sac. No symptoms. Small atrophied testicle placed in abdomen. Three and one-half years later, no symptoms, no return of hernia. Testicle not felt; had not reentered canal.

CASE 45.—1900. Aged twenty-five years. Right inguinal retention with incarcerated congenital hernia. No symptoms referable to testicle. Operation for hernia; testicle returned to abdomen. Three years later, no symptoms. Testicle could not be felt; no recurrence of hernia.

CASE 74.—1903. Aged twenty years. Double inguinal retention. Pain for two years. Both testicles returned to abdomen. Six months later, no symptoms; neither testicle to be felt.

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TABLE OF CASES.

No.	Age.	Date.	Side.	Position.	Operation.	Complications.	Service of	Remarks.
1	30	1877	R.	Pubic.	o	o	G. G. Tarbell.	Death; meningitis. Plate III, Fig. 1.
2	46	1879	L.	Abdominal.	o	Sarcoma.	C. B. Porter.	Death in one year.
3	14	1886	R.	Pubic.	o	Inguinal hernia.	M. H. Richardson.	Left testicle descended at five years of age.
4	21	1887	R.	Pubic.	Relieved by manipulation.	o	A. T. Cabot.	
5	30	1888	R.	Pubic.	For strangulated hernia.	Strangulated inguinal hernia.	H. H. A. Beach.	Died in hospital.
6	22	1888	R.	Inguinal.	Orchidectomy.	Tuberculosis of testicle.	M. H. Richardson.	Pathological Report. (William F. Whitney.)
7	48	1889	Double.	R. pubic. L. subcutaneous.	R. orchidectomy. L. orchidectomy.	Double inguinal hernia.	J. Homans.	
8	30	1890	R.	Pubic.	Orchidectomy.	Inguinal hernia.	A. T. Cabot.	
9	20	1892	R.	Inguinal.	o	Inguinal hernia.	A. T. Cabot.	Hernia reduced; ether. Died, 1895.
10	26	1892	R.	Pubic.	Orchidectomy.	Inguinal hernia.	A. T. Cabot.	
11	20	1893	R.	Inguinal.	Orchidopexy.	Inguinal hernia.	J. Homans.	Examined December, 1903.
12	23	1894	R.	Pubic.	o	Strangulated congenital hernia.	J. C. Warren.	Operation for hernia. Death.
13	18	1894	L.	Puboscrotal.	o	Inguinal hernia.	J. C. Warren.	Operation for hernia.
14	23	1894	L.	Pubic.	o	Inguinal hernia.	J. C. Warren.	Operation for hernia reported December, 1903.
15	37	1894	Double.	R. abdominal. L. abdominal.	R. o L. o	o o	H. H. A. Beach.	Right testicle seen at appendectomy. Died six months later.
16	5	1894	R.	Inguinal.	Orchidopexy.	Inguinal hernia.	S. J. Mixter.	Examined December 1903.
17	33	1894	R.	Inguinal.	o	Inguinal hernia.	H. H. A. Beach.	
18	20	1895	R.	Inguinal.	o	Strangulated inguinal hernia.	H. H. A. Beach.	Hernia reduced; ether. Examined December, 1903.
19	46	1895	Double.	R. inguinal. L. inguinal.	R. o L. o	R. sarcoma. L. sarcoma.	F. C. Shattuck.	Death in hospital; autopsy.

20	14	1895	Double.	R. inguinal. L. inguinal.	R. o L. put in abdomen.	o	S. J. Mixter.	Parotitis. Examined December, 1903.
21	24	1895	R.	Inguinal.	Put in abdomen.	Periorchitis.	S. J. Mixter.	
22	14	1896	Double.	R. pubic. L. puboscrotal.	R. o L. o	o	A. T. Cabot.	
23	27	1896	Double.	R. abdominal. L. inguinal.	R. o L. orchidectomy.	R. o L. congenital inguinal hernia, torsion of cord.	J. W. Elliot.	
24	42	1897	L.	Pubic.	Orchidopexy.	R. inguinal hernia.	F. B. Harrington.	Operation for hernia on right. Examined December, 1903.
25	21	1898	L.	Abdominal.	o	Inguinal hernia.	J. Homans.	Operation for hernia. Examined December, 1903.
26	49	1898	R.	Inguinal.	Orchidectomy.	Sarcoma.	C. B. Porter.	Death, January, 1902. Recurrence. Specimen.
27	10	1898	Double.	R. abdominal. L. inguinal.	R. o L. orchidopexy.	R. o L. congenital inguinal hernia.	S. J. Mixter.	
28	28	1898	L.	Abdominal.	Orchidectomy.	Sarcoma.	J. Homans.	Death in one year. Recurrence. Plate IV, Fig. 1.
29	19	1899	L.	Puboscrotal.	Orchidectomy.	Strangulated congenital hernia.	C. B. Porter.	
30	13	1899	Double.	R. abdominal. L. inguinal.	R. orchidopexy. L. orchidopexy.	R. o L. congenital hydrocele.	J. Homans. A. T. Cabot.	Left operated, 1899; right, one year later. Plate IV, Fig. 2.
31	19	1899	R.	Pubic.	Orchidopexy.	o	J. W. Elliot.	
32	11	1899	L.	Inguinal.	Orchidopexy.	Inguinal hernia.	C. B. Porter.	Examined December, 1903.
33	21	1899	R.	Inguinal.	Orchidectomy.	Inguinal hernia.	C. B. Porter.	Pathological Report. (William F. Whitney.)
34	23	1899	R.	Abdominal.	Orchidectomy.	o	H. H. A. Beach.	
35	19	1899	R.	Pubic.	Orchidopexy.	Congenital hydrocele.	C. B. Porter.	Died, 1902. Tuberculosis.
36	46	1900	R.	Abdominal.	Orchidectomy.	Sarcoma.	Private case. H. Jackson.	Died two months later. Recurrence. Autopsy.
37	26	1900	Double.	R. inguinal. L. inguinal.	R. orchidopexy. L. orchidopexy.	Double inguinal hernia.	M. H. Richardson.	Examined December, 1903.

TABLE OF CASES.—*Continued.*

No.	Age.	Date.	Side.	Position.	Operation.	Complications.	Service of	Remarks.
38	27	1900	L.	Inguinal.	Orchidectomy.	Congenital inguinal hernia.	A. T. Cabot.	
39	9	1900	L.	Abdominal.	Put in abdomen.	Congenital inguinal hernia.	F. B. Harrington.	Examined December, 1903.
40	11	1900	Double.	R. inguinal. L. puboscrotal.	R. orchidectomy. L. o	R. inguinal hernia. L. o	A. T. Cabot.	
41	5	1900	Double.	R. inguinal. L. inguinal.	R. o L. o	R. inguinal hernia. L. o	M. H. Richardson.	
42	11	1900	R.	Abdominal.	o	o	M. H. Richardson.	Operation for acute appendicitis.
43	21	1900	R.	Inguinal.	Put in abdomen.	R. Congenital inguinal hernia. L. inguinal hernia.	F. B. Harrington.	Operation for hernia. Reported December, 1903.
44	16	1900	L.	Inguinal.	Orchidectomy.	Inguinal hernia.	C. B. Porter.	Specimen.
45	25	1900	R.	Inguinal.	Put in abdomen.	Strangulated congenital hernia.	H. H. A. Beach.	Reported December, 1903.
46	10	1900	R.	Inguinal.	o	Inguinal hernia.	H. H. A. Beach.	Examined December, 1903.
47	16	1900	L.	Abdominal.	Orchidectomy.	o	J. C. Warren.	Specimen. Plate I, Fig. 1.
48	32	1901	R.	Inguinal.	Orchidectomy.	Strangulated inguinal hernia.	J. W. Elliot.	
49	16	1901	R.	Inguinal.	Orchidopexy.	o	J. W. Elliot.	Examined December, 1903.
50	21	1901	L.	Pubic	Orchidopexy.	Inguinal hernia.	J. W. Elliot.	Examined December, 1903.
51	16	1901	R.	Inguinal.	Orchidectomy.	Inguinal hernia.	W. M. Conant.	Specimen.
52	20	1901	L.	Inguinal.	Orchidectomy.	Gonorrhœal epididymitis.	S. J. Mixter.	Pathological report. (J. H. Wright.)
53	11	1901	L.	Inguinal.	Orchidectomy.	Congenital inguinal hernia.	S. J. Mixter.	
54	37	1901	R.	Pubic.	Orchidopexy.	Strangulated inguinal hernia.	S. J. Mixter.	
55	20	1901	L.	Inguinal.	Orchidopexy.	Congenital hydrocele.	C. B. Porter.	Examined December, 1903.
56	12	1901	L.	Pubic.	Orchidectomy.	Strangulated congenital interstitial hernia.	J. C. Warren.	

57	2	1902	Double.	R. abdominal. L. abdominal.	R. o L. o	o	W. M. Conant.	Examined December, 1903.
58	8	1902	L.	Puboscrotal.	o	Inguinal hernia.	F. B. Harrington.	
59	7	1902	Double.	R. inguinal. L. inguinal.	R. orchidopexy. L. orchidopexy.	R. inguinal hernia. L. o	W. M. Conant.	
60	24	1902	L.	Inguinal.	Orchidopexy.	Congenital inguinal hernia.	S. J. Mixter.	Examined December, 1903.
61	7	1902	R.	Inguinal.	o	o	H. H. A. Beach.	
62	19	1902	R.	Pubic.	Orchidopexy.	Congenital inguinal hernia.	J. C. Warren.	Examined December, 1903.
63	13	1902	L.	Inguinal.	Orchidopexy.	Congenital inguinal hernia.	C. B. Porter.	Reported December, 1903.
64	24	1902	R.	Inguinal.	Orchidectomy.	Sarcoma.	H. H. A. Beach.	Died one year later. Recurrence. Specimen.
65	27	1903	R.	Inguinal.	Orchidopexy.	Strangulated inguinal hernia.	J. W. Elliot.	
66	18	1903	R.	Inguinal.	Orchidopexy.	Congenital hydrocele.	A. T. Cabot.	Examined December, 1903.
67	25	1903	R.	Inguinal.	Orchidectomy.	Congenital inguinal hernia.	A. T. Cabot.	
68	13	1903	R.	Inguinal.	Orchidopexy.	Congenital hydrocele.	J. W. Elliot.	Reported December, 1903.
69	5	1903	R.	Inguinal.	Orchidopexy.	Inguinal hernia.	J. W. Elliot.	Examined December, 1903.
70	30	1903	R.	Inguinal.	Orchidectomy.	Congenital hernia.	C. L. Scudder.	Specimen. Plate II, Fig. 3.
71	24	1903	L.	Inguinal.	Orchidectomy.	o	S. J. Mixter.	Specimen.
72	30	1903	R.	Inguinal.	Orchidectomy.	Inguinal hernia.	Private case.	Specimen.
73	29	1903	L.	Pubic.	Orchidectomy.	Congenital inguinal hernia.	J. C. Warren. Private case. H. Williams.	Specimen. Plate II, Fig. 1.
74	20	1903	Double.	R. inguinal. L. inguinal.	R. put in abdomen. L. put in abdomen.	R. o L. o	A. T. Cabot.	Reported July, 1904.
75	22	1903	Double.	R. inguinal. L. inguinal.	R. o L. orchidopexy.	R. o L. strangulated congenital hernia.	F. B. Harrington.	Examined.
76	21	1904	L.	Inguinal.	Orchidopexy.	Congenital inguinal hernia.	J. W. Elliot.	
77	23	1904	R.	Inguinal.	Orchidectomy.	o	A. T. Cabot.	Specimen. Plate I, Figs. 2 and 3; Plate II, Fig. 3.

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FIG. 1.—Hypernephroma. Showing the external appearance of the kidney and tumor about one-third smaller than at the time of operation.

I. HYPERNEPHROMA OF KIDNEY. II. FIBRO-ADENOMA OF INNER WALL OF ILEUM.

A CLINICAL REPORT.

BY FRANCIS S. WATSON, M.D.,

OF BOSTON, MASS.,

Surgeon to the Boston City Hospital.

CASE I.—*Hypernephroma of Kidney; Nephrectomy; Recovery; Death Fourteen Months Later, thought to be Due to Cerebral Embolism; No Clinical Evidence of Recurrence Prior to Death; Autopsy refused.*

A woman aged fifty-two years, in robust health until six months prior to May, 1903. Family history has no bearing on the case. Duration of symptoms, six months. The first noticed were bladder irritability and increased frequency of urination, soon followed by a sense of weight and dragging beneath the right lobe of the liver. Gastric disturbances soon becoming marked, loss of appetite, occasional nausea, and gastralgia gradually supervened, and associated with them were progressive pallor and loss of weight, the latter twenty-five pounds in the course of the six months.

Four months previous to being seen by the writer, she had for the first time an attack of hæmaturia associated with sharp lumbar (renal?) pain radiating to the bladder. The pain and the blood in the urine continued in this attack for twenty-four hours. For the following six weeks there was more or less dull pain in the region of the right kidney and radiating downward to the bladder.

She first entered the Boston City Hospital in April, 1903, in the service of my colleague, Dr. George G. Sears, through whose courtesy I have been furnished with the results of the physical examination made at that time, of which the following are the more important features:

Physical Examination, April 15, 1903.—Skin shows similar discoloration to that seen in Addison's disease. Examination of all organs other than the following was negative.

Heart.—Systolic murmur at apex propagated to axilla was the only abnormal thing found.

Abdomen.—A large tumor is present in the right upper, lateral, and anterior aspects of the abdomen. It appeared to be identified with a kidney. It extended from the lower border of the last rib behind and above, downward and forward to a point midway between the umbilicus and the crest of the ilium, and in front nearly to the mammary line.

Urine.—Pale, acid; specific gravity, 1016. A considerable sediment, consisting of pus, renal and bladder epithelium. There was a slight trace of albumen in the intervals of the attacks of hæmaturia when there was no blood present in the urine.

Blood.—White count, 6200; red, 2,700,000; hæmoglobin, 25 per cent. During the ensuing interval of four weeks or so before the writer saw the patient in consultation with Dr. Sears and her transfer to the surgical side of the hospital, there was three further attacks of hæmaturia, one of which was of considerable severity, and the patient continued to slowly lose ground.

Operation.—Ether anæsthesia, May 27, 1903. The tumor was exposed by a five-inch incision made through the right linea semilunaris, and was seen to have its seat in the kidney. The growth was laid bare by incising the overlying peritoneum, and the field of operation was excluded from the general peritoneal cavity by suturing the edges of this incision to the outer wound in order that the removal of the kidney should be conducted extraperitoneally. It was found necessary later to prolong the first incision, which was done by a transverse cut extending from the upper end of the former to the edge of the quadratus lumborum. The kidney and tumor formed a mass about one-third larger than shown in the accompanying illustrations. (Figs. 1 and 2.) There were numerous but not dense adhesions between the renal capsule and the perinephritic tissues. The capsule was moderately thickened. The ureter and the vessels were ligated separately, divided, and the kidney removed. The ureter was ligated low down below the iliac vessels because of the suspicion that the growth involved it. The temporary sutures attaching the margins of the peritoneal incision were removed, and the latter was closed above the space made by the removal of the



FIG. 2 shows appearances of kidney and tumor on section through the long axis of the organ and its pelvis.

kidney, and the outer wound closed except for a small part which was left open posteriorly for drainage.

Subsequent Course.—The patient bore the operation well. The subsequent course of convalescence was uninterrupted, except by the formation of a small superficial abscess occurring seven days after operation, and by the persistence of a very small sinus, which occasionally opened during the ensuing four or five months.

Urine.—In the first twenty-four hours the quantity passed was thirteen ounces. It was cloudy and concentrated, and contained a slight amount of microscopic blood. From third day the daily quantities were about thirty-five ounces, and at the end of the sixth week there were no longer any abnormal elements in the urine. Urea averaged about 1.9 per cent. after the first ten days.

The patient gained rapidly in strength and in general condition, was out of bed in twenty-eight days, and was discharged well about a fortnight later. The dusky color of the skin gradually disappeared. She remained in perfectly good health for fourteen months after the operation, and then suddenly died without any preceding illness. The clinical diagnosis was cerebral embolism. Autopsy was unfortunately not permitted.

Pathological Report of the Specimen.—The mass retains the general outline of the kidney. The external surface is generally nodular, with many points of injection from adhesions. The nodules vary in size from three to six centimetres in diameter, and compose practically the whole upper half of the kidney. The capsule is thickened and firmly adherent over the nodular area. On section, the whole upper half of the organ is occupied by a new growth, except for a small bit of renal tissue at the tip. There is one-half calyx in the lower half from which pyramidal tissue radiates. This area presents small, yellowish, discrete nodules, a few millimetres in diameter scattered through it, and the cortex is poorly defined. The tumor mass, which occupies the whole upper half of the kidney, extends from just beneath the capsule into the pelvis of the kidney. It possesses a distinct capsule of its own. The tumor is generally yellowish in color, with areas of hæmorrhage scattered through it. There is an irregular trabeculation of a firm, lighter-colored tissue making many small compartments of yellowish or reddish-yellow tissue. Some of these areas have degenerated and are soft, but for the

most part the growth is firm and elastic. Histological diagnosis, hypernephroma.

In the Medical and Surgical Reports of the Boston City Hospital, 1903, there is an admirable article by Drs. Paul Thorndike and J. H. Cunningham upon the subject of hypernephroma, in which reference is made to this case as one of a series, and in which there are three figures, illustrating the typical histological appearances of this variety of new growth, which were taken from specimens cut from the tumor of this kidney, and which are here reproduced by the courtesy of the writers of the above mentioned article. (Figs. 3, 4, and 5.)

Case II.—*Fibro-Adenoma of Inner Wall of Ileum causing Intestinal Obstruction; Resection of Fourteen Inches of the Intestine, including the Tumor; End-to-End Suture; Uneventful Recovery, December* 2, 1903. The patient, a woman aged forty-four years; previous history of good health until six weeks previous to being admitted to the surgical service of the Boston City Hospital. At that time she began to have attacks of colicky pains in the abdomen, increasing gradually in severity up to the present. Associated with these attacks of pain there were alternating constipation and diarrhœa. For the last few days there has been no movement of the bowels, and the abdominal pain has become worse. General health has not suffered importantly. The pain has not been localized in one part of the abdomen at any time. Intestinal peristalsis well marked, can be seen and felt during the attacks of pain. Examination of the heart, lungs, liver, spleen, stomach, uterus, and adnexa negative. The abdominal wall is rather relaxed and flabby. There is no evidence of acute peritoneal inflammation.

On the right side of the abdomen is a tumor about the size of an orange, but of oblong form. It is freely movable, and can be pushed readily from the position which it usually occupies—just below the border of the right lobe of the liver—to a point below the crest of the ilium and beyond the median line also. The tumor changes its place also spontaneously from time to time within the above-named radius.

Operation.—The abdomen was opened in the right linea semilunaris by a three-inch incision. The tumor was then seen to have its seat within the small intestine-ileum, a little below the jejunum.

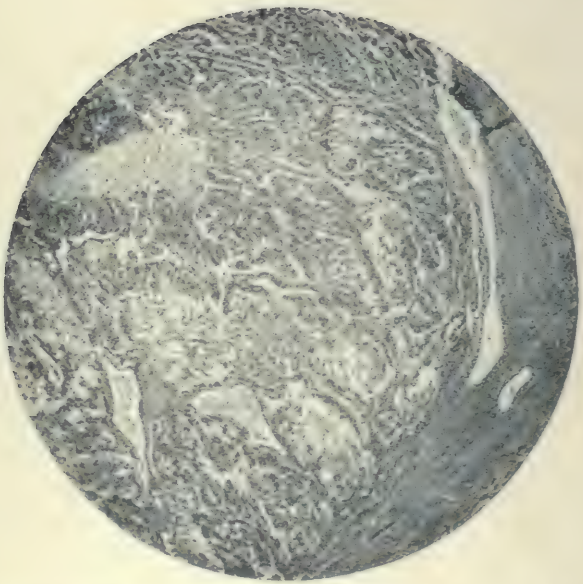


FIG. 3.—Case I. Stained with methylene blue and eosin. × 25 diam. Note thin capsule with lymphoid cell infiltration below; wide vascular spaces; general tubular or adenomatous appearance; areas of degeneration above (pale staining).

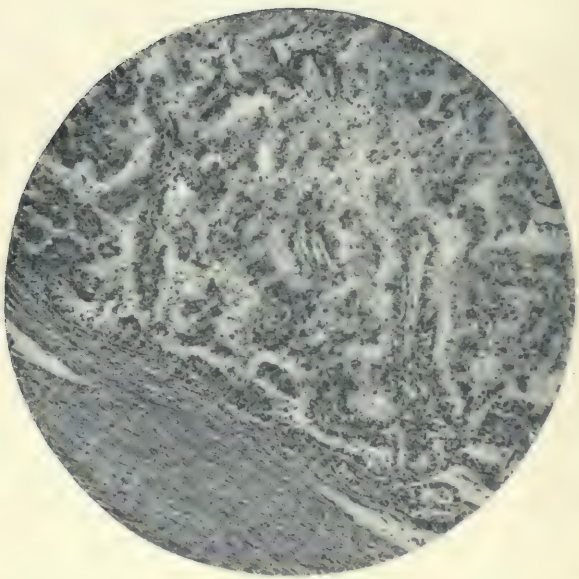


FIG. 4.—Case I. Stained with methylene blue and eosin. × 80 diam. Note vascular stalks; tubular appearance emphasized by lighter spaces (in part due to cell degeneration) lying outside well-nourished cells immediately facing capillaries.

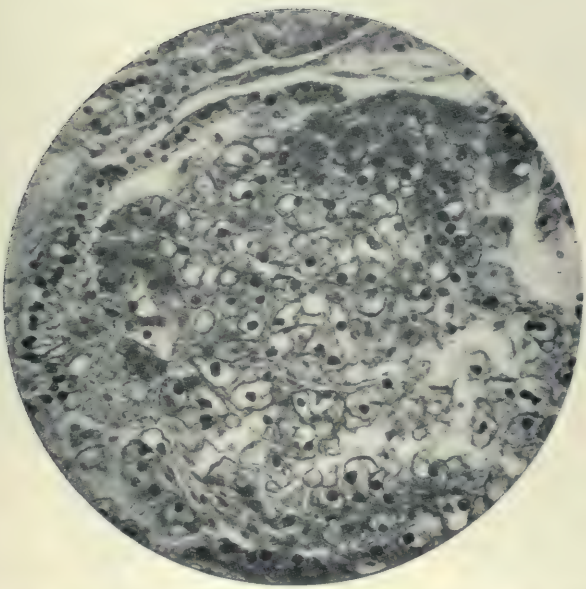


FIG. 5.—Case I. Stained with methylene blue and eosin. × 200 diam. Note oval or polygonal shape of cells; preservation of their rim of cytoplasm; deeply staining nuclei sometimes lying upon cytoplasm threads; the perinuclear, lightly staining spaces, often filling the whole cell, and somewhat characteristic of hypernephroma.



FIG. 6.—Case II. Benign fibroadenoma growing from the inner wall of the ileum. Actual reproduction will be four-fifths of actual size. Intestine is divided longitudinally, and its inner surface is shown with tumor growing from it.

The intestinal wall for twelve inches above the seat of the tumor was greatly thickened, in places inflamed; and the mesentery corresponding to this area was likewise thickened and its glands enlarged and indurated. The tumor was egg-shaped and of firm consistency, and was somewhat movable within the lumen of the intestine.

Fourteen inches of the intestine, including somewhat more than the thickened portion of it, and also the whole of the above noted part of the mesentery, were removed, together with the tumor. The severed ends of the bowel were brought together by an end-to-end suture with Cushing right-angle stitch. The abdominal wound was closed without drainage.

The patient made an uninterrupted recovery, and was discharged well and entirely relieved of her previous symptoms at the end of the third week after the operation.

The part of the bowel which had been removed on being laid open lengthwise showed a tumor of the size and form that appear in the accompanying illustration. (Fig. 6.)

Examination of the specimen showed the growth to be a benign fibro-adenoma. The enlargement of the mesentery and its glands was of inflammatory origin, and that of the intestine was due in part to hypertrophy of its muscular structure and in part to inflammatory changes. The distal end of the tumor had an ulcerated area upon it about the size of a one cent coin, otherwise the surface was smooth and had undergone no degenerative changes. The growth sprang from the inner surface of the intestine, to which it was connected by a pedicle about one-quarter of an inch in diameter. Its surface was smooth and in texture the growth was firm and fleshy. The color of the surface was that of normal mucous membrane except at the point occupied by the ulcer above noted. The patient was seen eight months later and was well.*

* Unfortunately, the specimen was mislaid before a thorough histological examination could be made of it; hence the meagreness of the report in this respect. Apart from that feature of the case, its interest lay in the difficulties in making an exact diagnosis before the operation, in the large size of the growth, and its relative rarity. It measured in its long diameter three and one-fourth inches, and in its transverse one just a fraction less than two inches.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting, October 26, 1904.

The President, HOWARD LILIENTHAL, M.D., in the Chair.

ACUTE HÆMATOGENOUS INFECTION OF THE KIDNEY.

DR. GEORGE E. BREWER presented a woman, twenty-two years old, who was admitted to Roosevelt Hospital early in October of the present year. She was supposed to be suffering from acute appendicitis. Five days before admission she was suddenly seized with an acute pain in the right side of the abdomen, which was so severe that she was obliged to leave her work and go to her home. During that day her sufferings were intense, and consisted, in addition to her pain, of severe nausea, some vomiting, chills, and fever. During the next four days her condition remained about the same, and on admission to the hospital her temperature was found to be 104° F.; pulse, 130, and of poor quality.

There was marked tenderness over the entire right half of the abdomen, more particularly over the gall-bladder in front and the costovertebral angle behind. From these points downward the tenderness gradually diminished. At McBurney's point only slight tenderness could be elicited on deep pressure. There was moderate rigidity of the right rectus muscle, more marked above than below. Vaginal examination revealed slight tenderness in the right half of the pelvis, and by bimanual palpation this tenderness seemed to be limited to the region of the Fallopian

tube, which was slightly thickened. The urine contained a trace of albumen, hyaline and granular casts, and a few pus-cells. Cystoscopic examination was negative. The ureters were catheterized, and urine drawn from the right kidney differed from the left only in showing a few more white cells. Blood examination gave a leucocytosis of 18,000.

The night after her admission the patient's temperature rose to 105° F., and remained between 103° and 105° for three days. On the fifth day after her admission she was apparently getting more septic and prostrated, and, as there was considerable difference of opinion regarding the diagnosis, an exploratory laparotomy was quickly made under ether anæsthesia. Nothing abnormal was found in the gall-bladder, liver, cæcum, or duodenum. Through the abdominal wound the kidney was palpated and thought to be somewhat enlarged. A second incision was made in the lumbar region exposing the kidney. The areolar tissue in the retroperitoneal space was œdematous, as was the fatty capsule and kidney. On removing this the kidney appeared deeply congested, with numerous subcapsular hæmorrhages. It was incised, and the cortex was found to be the seat of numerous infarcts. A hasty nephrectomy was done, the wound closed in the usual manner, and a dressing applied.

The patient's temperature dropped in six hours from 105° to 97.5° F., and during the following two days was most of the time subnormal. Her convalescence was rapid, the stitches being removed at the end of ten days. The secretion of urine from the first was satisfactory, varying from thirty to sixty ounces in twenty-four hours.

The case was of interest, Dr. Brewer said, for the reason that the lesion was undoubtedly a secondary one, due to blood infection, and was apparently the only lesion of any importance in the body, furnishing all, or nearly all, of the toxins which gave rise to her grave symptoms. In reply to a question, the speaker said that no cultures were made.

Dr. Charles H. Peck, who had seen the patient shown by Dr. Brewer, said that the clinical picture presented was one of violent sepsis, and it was difficult to believe that the kidney was the only source of infection, without any other focus in the body. The rapid subsidence of the symptoms after the removal of the kidney was very striking.

Dr. Andrew J. McCosh said that a few years ago he saw a young physician some weeks after a severe attack of measles. Following this, he became desperately ill, and at operation it was found that two abscesses had developed in the kidney, one at the upper, the other at the lower pole, which did not involve the pelvis of the organ. The urine had shown no trace of pus. The kidney was incised, and the abscesses opened and drained. The patient made a slow recovery, and was now entirely well and practising his profession.

Dr. Lilienthal referred to a case he had reported some years ago. The patient had an attack of erysipelas, followed by a multiple hæmatogenous infection of both kidneys. Repeated nephrotomy was done on both sides, and the kidneys were saved. In Dr. Brewer's case, however, the violent onset of the symptoms and their persistence certainly called for nephrectomy. The speaker said it was to be regretted that no cultures were made from the infarcts.

Dr. Brewer, in closing, said the source of the kidney infection could not be found. There was slight tubal tenderness, but this had never interfered with her work.

PAPILLOMA OF TRACHEA.

Dr. Brewer presented a boy, aged eleven years, who was admitted to the Roosevelt Hospital in July last. When five years old, he had suffered from extensive papillomatous disease of the larynx, which interfered considerably with respiration. After unsuccessful local treatment, an operation was advised by those in attendance. This was declined by the parents, and the condition grew steadily worse until the dyspnœa became so severe that an emergency tracheotomy was done. The tube was worn continuously for a number of months, during which time local treatment was applied to the laryngeal mucous membrane. Several attempts were made to remove the tube, but on each occasion marked difficulty in breathing followed, necessitating immediate replacement.

After consulting a number of surgeons and laryngologists, the boy finally came under the care of Dr. Frank E. Miller, of this city, who by persistent local applications succeeded in removing the greater portion of the laryngeal growth. This, while it left a sufficient opening in the glottis for ordinary respiration,

afforded no relief, for as soon as the tube was removed the dyspnœa was extreme. It was evident that an obstruction existed in the trachea immediately above the opening for the cannula.

The boy's general condition was poor; he was anæmic, had a chronic bronchitis, and was exceedingly thin. Around the tracheal opening there was an extensive area of inflammation.

On July 5, 1904, under ether anæsthesia, an incision was made in the median line extending from the body of the hyoid to the sternum. The trachea was exposed with considerable difficulty below the original tracheotomy wound, where it was incised and a new tube inserted. The soft parts were then removed from the larynx and the upper segment of the trachea. After all hæmorrhage was arrested, the patient was placed in the Trendelenburg position, and the larynx and trachea freely opened by a median incision extending from the thyrohyoid membrane to the original opening in the trachea. A solution of adrenalin chloride was immediately applied to the cut surfaces and to the laryngeal and tracheal mucous membranes. The tracheal wall was then retracted, exposing the entire mucous lining. Immediately above the old tracheal opening there was found a large papillomatous mass completely plugging its lumen, and attached by a comparatively small pedicle to the left side of the trachea. The mass was about the size of a large blackberry. It was easily removed, and its point of attachment touched with the actual cautery. Several papillomatous masses on and below the vocal cords were also removed. A large rubber tube was then placed within the trachea, extending from the lower tracheal opening upward through the larynx into the pharynx. This was secured by a thread passed from its upper extremity upward through the mouth and tied to the right ear. The trachea was closed over this by one or two catgut sutures; the cutaneous wound was partly closed, and the dressing applied.

The operation was followed by moderate shock. The rubber tube was coughed out at the end of six hours. No embarrassment of the respiration followed its removal, and the patient's convalescence was uneventful. He gained rapidly in flesh and strength, and his bronchitis entirely disappeared. He was now able to go to school, and, although his voice had not returned completely, it was constantly improving.

PAPILLOMA OF THE LARYNX AND TRACHEA.

Dr. John F. Erdmann showed photographs of a girl, now about seven years old, who was referred to him by Dr. C. G. Coakley, and was operated on in November, 1903. She had been operated on at the age of three years by a physician in the South for papillomata of the larynx; so far as could be learned from the history, a high tracheotomy was done and the larynx curetted through this incision.

When the patient came under Dr. Erdmann's care, about two and one-half years later, she presented a dense, cicatricial area in the neck, which corresponded to the upper three tracheal rings and the cricoid cartilage. She was suffering from dyspnœa to such an extent that an emergency operation was necessary. Dr. Coakley had been able, by laryngoscopic examination, to recognize the presence of the papillomata. Tracheotomy under cocaine was done, then a tube was introduced, and chloroform given by means of a funnel and long tube. Owing to the child's condition, it became necessary to substitute ether for the chloroform. A thyrotomy was then done, and a papillomatous mass about the size of a large filbert enucleated. The base of this papilloma was then touched with carbolic acid, the split thyroid cartilage was brought together with catgut, and the wound in the neck closed with the exception of the point where the tracheal tube was inserted. The wound healed rapidly and the tube was removed within a few days. A few weeks later, however, the dyspnœa recurred. This was thought to be due to a stricture formation as the result of the removal of the mucous membrane and the application of pure carbolic acid. Acting on this supposition, intubation was done and gave entire relief. Upon the removal of the intubation tube, however, profound dyspnœa would recur, and in one of these attacks it was necessary to do a tracheotomy before the tube could be replaced. Successive sized tubes were introduced with the view of preventing stricture formation, and also to try the effect of pressure upon the papillomatous growths, which were known to have recurred.

The child's family were anxious to take her away for the summer, and in order to be on the safe side it was deemed advisable to insert a tracheal tube and remove the intubation tube. This was done in June, and at that time the tracheal wound was perfectly clean. Three months later, on her return, a large papillo-



FIG. 1.—Papilloma of larynx and trachea.

matous mass surrounded four-fifths of the opening of the tracheal wound; this was partially sessile, extending to the edge of the wound, and partially pedunculated, protruding from the trachea between the edges of the wound and the tracheal tube. (Fig. 1.)

The second operation was done by Dr. Erdmann three weeks ago. The papilloma at the tracheal wound was cut off, and the incision extended downward as far as possible. It was observed that with each expiration the tube through which the ether was being administered would become plugged, spreading the edges of the wound. This proved to be due to the fact that a pedunculated papilloma, fully the size of a hazel-nut, was acting as a ball-valve. This growth was pulled up through the wound and excised. The wound was then extended upward, again splitting the thyroid cartilage and cutting to the hyoid bone and dividing the base of the epiglottis. Papillomata were found all the way up to the epiglottis, and a large mass protruded upward into the oropharynx. After thorough extirpation, the mucous membrane was carefully dissected from all suspicious looking areas. The tracheal tube was left in the lower angle and the wound packed. It was considered advisable to leave the wound open, so that proper treatment could be instituted in case of a recurrence. This proved to be a wise precaution, as very recently the upper portion of the wound showed a fungous growth which pointed to a recurrence.

Dr. Robert H. M. Dawbarn asked Dr. Brewer whether in dealing with these cases it would not be advisable to save the cricoid cartilage. Unless this cartilage thoroughly reunited, it would seriously interfere with the *timbré* of the voice, and the division of this rigid band was to be deprecated unless it was absolutely necessary.

Dr. Brewer, in closing, said his reason for cutting the cricoid cartilage was that a child of this age had a very delicate trachea, and it would have torn even upon slight traction. It was thought better to divide the cricoid, therefore, rather than run the risk of tearing loose the trachea from that cartilage.

CONGENITAL INVERSION OF THE APPENDIX.

Dr. Brewer presented a woman, twenty-two years old, who was admitted to the Roosevelt Hospital in the spring of 1904, suffering from pain, tenderness, and muscular rigidity in the

right iliac fossa, together with fever, nausea, vomiting, and prostration.

On examination, there was acute tenderness in the region of McBurney's point, and on deep pressure an indefinite mass could be felt, strongly suggesting an appendicular abscess. On opening the abdomen, a dense mass of adhesions was found, consisting of the cæcum, omentum, and several loops of small intestine. These were with difficulty separated, but after prolonged search no sign of an appendix could be found. The cæcal wall seemed somewhat thickened, and in the course of the search for the appendix the cæcum was wounded, but immediately repaired. The search for the appendix was a very thorough one, and was continued until the condition of the patient necessitated the closure of the wound. She made a prompt recovery from the operation, and was discharged in about three weeks. From time to time during the next five months she returned to the hospital, complaining of pain in the right inguinal region, which was so severe on exertion as to prevent her attending to her household duties.

On examination, the patient was found to be anæmic, badly nourished, excessively nervous and hysterical. On attempting to palpate the abdomen she screamed, cried, and moved about to such an extent that successful palpation was impossible. This led to the opinion that the condition was largely hysterical, and no operative interference was advised for several weeks. Her persistent complaints, however, finally led to the proposal of an exploratory laparotomy, in the hope of finding something to account for the symptoms.

Early in July, 1904, under ether anæsthesia, the abdomen was opened by the Kammerer incision, along the outer border of the right rectus muscle. On opening the peritoneal cavity a dense mass of adhesions was encountered, necessitating considerable dissection before the structures could be identified. The cæcum was finally isolated, and its three longitudinal bands followed downward to their junction at the inferior extremity of the gut, but no trace of an appendix could be found. The cæcum was then dissected free from the abdominal wall, and, with the ileum, raised so that every part could be thoroughly inspected. By this means, Dr. Brewer said, they were able to convince themselves that no trace of an appendix existed. At the usual site

of the appendix implantation, however, a small oblong tumor was felt within the cæcum. There was also a distinct transverse thickening of the colon just above the ileocæcal valve, which apparently formed a decided narrowing of its lumen. The bowel was incised longitudinally through its cicatricial band, and its cavity freely explored. It was found that this band formed a stricture which barely admitted the tip of the forefinger. The cavity of the cæcum itself seemed normal in size, but from its inferior extremity there projected inward a rounded mass, about one inch in length and with a diameter corresponding to that of an ordinary lead-pencil. This mass seemed covered with a thickened mucous membrane of a deep red color. It was suggested at the time that the mass had the appearance of an inverted appendix which had been chronically inflamed. The mass was divided with scissors at its attachment, and the mucous membrane stitched over the stump. It was preserved in a mild solution of formalin and sent to the Pathological Laboratory of the College of Physicians and Surgeons for examination.

The wound in the cæcal wall was closed by a row of sutures, converting the longitudinal into a transverse wound, which resulted in a very considerable enlargement at the point of stricture. The patient made a satisfactory convalescence, the wound healing primarily. Since the operation she has been entirely relieved of her symptoms, and has gained considerably in weight and strength.

The following is the report of Dr. Norman E. Ditman, Assistant Pathologist at the Roosevelt Hospital: The specimen shows a section of an inverted appendix, epithelium of the mucous membrane being present upon both the inner and outer surfaces of the mass. The peritoneal surfaces have become fused, and throughout the greater part of their extent there is no sharp line of demarcation between the two layers. The appendix is the seat of a mild, chronic inflammation. In addition to this there is a recent exudation of pus-cells, with great congestion and dilatation of the peripheral capillaries, pointing towards a strangulation at some point nearer the base.

Dr. Peck said he was present at the first operation, and could verify the statement that the appendix was not removed. A very thorough search was made without succeeding in finding it. The bowel itself was accidentally opened, but no sys-

tematic search of its interior was made. There was a good deal of evidence of typhlitis or inflammation of the entire cæcal wall at the time of the primary operation.

RESULT OF EXCISION OF MIDDLE THIRD OF BOTH STERNO-CLEIDOMASTOID MUSCLES.

Dr. Robert H. M. Dawbarn presented a woman, twenty-two years of age, who four years ago began to develop tubercular lymph nodes in large masses beneath the sternocleidomastoid muscles, chiefly upon both sides, but worse upon her left, which side was first operated upon, therefore. In order to obtain light and room for safe work, the muscle in question was divided in its lower part, about the junction of the lower third with the upper two-thirds. As the operation presently showed, pressure by the mass of diseased glands had led to obliteration of all vessels passing downward in the muscular substance from its origin or thereabouts; consequently, he feared for the life of the central portion of the muscle, now cut off from nourishment both below and above. On the fourth day Dr. Dawbarn revised the wound and cut away the middle third of the sternomastoid, now plainly dead and beginning to decompose. Also, as a corresponding length of the deep jugular was sloughing, it was deemed safest to prevent a possible secondary hæmorrhage by tying above and below and excising the same length of this vein. The corresponding pneumogastric nerve was apparently gangrenous, but was left, with gauze drainage of the wound. Before this revision (twenty-four hours) the heart began to race; and from that time, for a few weeks subsequently, this tachycardia was continued in spite of various medicinal attempts at slowing the pulse-rate. It ran between 120 and 150, and notwithstanding there was no dyspnœa nor cyanosis from walking about the room. Ultimately, the heart action became normal once more.

A few months after the first operation, Dr. Dawbarn extirpated the enlarged glands on the opposite side of the neck, and for the sake of symmetry took out the middle third of the sternocleidomastoid muscle on that side, too. The removal of this section of the muscle on both sides apparently had no effect whatever on the motion of the parts, as was demonstrated before the society—the patient moving her head freely in all directions. Moreover, whereas formerly her muscles stood out prominently from a thin

neck, now the neck is round and shapely; much the better in appearance for their loss. Dr. Dawbarn expressed surprise that such large and active muscles should not be missed in function.

The patient was also suffering from an extensive lupus erythematosus involving both sides of the face. One side had been treated with the X-rays, the other with the Finsen rays, and the lesions had apparently improved to a somewhat greater degree under the latter than under the former therapeutic agent.

In the neck, one gland, the size of a chestnut, had appeared beneath the body of the lower jaw since the operations. This, upon suggestion of Dr. Tiffany, of Stamford, Connecticut, he had treated by daily inunction of an ointment of phytolacca, with benefit. At present it is reduced fully one-half.

As a further point of interest in this case, at this first operation upon her left, while dissecting out bluntly the lowest glands, about three centimetres below her clavicle, the wound suddenly filled with a milky fluid. Fortunately, this happened coincidentally with the removal of the diseased gland in question; and prompt packing with gauze, maintained in place for ten minutes, was not followed upon its withdrawal by any further escape of chyle. Such a tear into the thoracic duct is new in Dr. Dawbarn's personal experience.

Dr. Brewer said he agreed with Dr. Dawbarn that removal of the sternocleidomastoid was attended with very little loss of function. In a case he saw last winter he was obliged to remove nearly the entire muscle on one side. The operation was not followed by torticollis, and almost normal motion had since been regained.

INOPERABLE ROUND-CELLED SARCOMA OF THE CHEST WALL, INVOLVING RIBS, SUCCESSFULLY TREATED BY MIXED TOXINS OF ERYSIPELAS AND BACILLUS PRODIGIOSUS.

Dr. William B. Coley presented a boy, sixteen years old, who enjoyed good health up to 1903, when he had an attack of what was considered to be pleurisy with effusion. He was aspirated, but the dulness over the chest persisted, and he rapidly lost flesh and strength. He was sent South without improvement, and early last March entered the Johns Hopkins Hospital, where he was operated on for a supposed empyema. A

large incision was made, revealing a necrosis of the eighth and ninth ribs, and behind these some gelatinous masses were found. These were partially removed and pronounced round-celled sarcoma. On the 26th of last May the patient was admitted to the General Memorial Hospital, where for two months he was treated with regular injections of the mixed toxins of erysipelas and bacillus prodigiosus. He also had X-ray treatment three times a week. At the beginning of the treatment there was a mass about the size of a man's hand over the ribs, with an extensive, sarcomatous-like sloughing area in the centre. The tumor has entirely disappeared. The patient's general health had also improved and he had gained twenty-six pounds in weight. He returned to his home in Canada, since which time he has received from two to three injections weekly of the mixed toxins in smaller doses.

STRICTURE OF THE ŒSOPHAGUS.

Dr. John A. Hartwell presented a male infant, twenty months old, who was admitted to Bellevue Hospital on June 30, 1904. About two months previous to his admission he had swallowed a few drops of caustic potash, which burned his lips and mouth. A month or six weeks later his mother noticed that he had difficulty in swallowing. On admission, he could swallow fluids only, and with difficulty.

An attempt was made to pass an œsophageal bougie three millimetres in diameter, but this was stopped about five inches from the teeth-line. Gastrostomy was done in July 5, under ether anæsthesia, by the Kader method. For two weeks subsequent to the operation the child was fed through the mouth, taking peptonized milk and broth without any leakage from the gastrostomy wound. By that time the wound had healed, and a non-inflamed opening into the stomach presented. On July 19 the patient was given a glass of milk with a silk thread coiled up in it. This he swallowed, and by means of a blunt hook the thread was caught and drawn out through the gastrostomy wound on the first attempt. This was left *in situ* for twenty-four hours to accustom the boy to its presence, and then a No. 14 olive-tipped bougie of the Dunham pattern was drawn down to the stricture by means of the silk. A fish-line thread was then drawn through the œsophagus beside the bougie and brought to bear

on the stricture. With the pharyngeal and stomach guides *in situ*, the stricture was cut with ease, and the olive bulb on the wire passed through the point of stricture. This was repeated with increasing sized bougies, until a No. 32 F. could be introduced, the length of stricture cut appearing about three-quarters of an inch. The same night the patient was allowed fluids by the mouth. These he took without difficulty. The thread was left *in situ*, and the gastrostomy wound kept open by passing a catheter through it once daily. The œsophageal bulbs of Dunham were passed at ten-day intervals for a month, and then the conical whalebone bougie of thirty-five millimetres circumference was passed by mouth. The gastrostomy wound was then allowed to close spontaneously, and by the passage of the latter bougie every ten days the stricture has been kept open, so the child swallows ordinary food with ease. A longer interval than ten days permits of sufficient contraction to produce a difficulty in taking solid food.

Dr. Dawbarn said that about ten years ago he saw a hysterical girl who was suffering from repeated nose-bleeds, and it finally became advisable to tampon the nasopharynx. The patient, however, refused to permit the catheter to be introduced through the nose. Dr. Dawbarn then asked for some sewing-silk, and rolling about five or six feet of it into a tight ball he introduced this into the nose, and then she inhaled it and hawked it up through the mouth.

Dr. Hartwell, in reply to a question as to what the normal caliber of the œsophagus of a young child was, said he had no definite information on that point, but from observations made in the dissecting-room he was led to believe that it was about No. 35 F. He had found that this sized bougie easily passed through the normal parts of the œsophagus in this case. In connection with the subject of œsophageal stricture, Dr. Hartwell said he had recently heard of a case under the care of a Boston surgeon in a patient who refused to submit to gastrostomy. She was given a string to swallow with drinking-water, and the string was allowed to pass through the stomach and for some distance along the intestine. In this manner the lower end of the string became so firmly fixed that it could be rendered taut from above, and served as a guide for the passage of a tunnelled bougie into the stomach.

FRACTURE OF LOWER END OF FEMUR, WITH VICIOUS UNION.

Dr. Hartwell presented a boy of sixteen years who was admitted to Bellevue Hospital on July 27, 1904. Four months previously a horse he was riding fell with him, his right leg and lower thigh being caught between the horse and the pavement. He was taken to a hospital and put to bed with no other treatment than an ice-bag applied to the knee. He did not recall how long it was before he was allowed to get up and walk about.

On his admission to Bellevue the following condition was found to exist: The right knee could be hyperflexed, both actively and passively, but extension was limited to about 160 degrees passively, and a little less actively. There was no pain in this movement. The hindrance to complete extension seemed to be bony, although the posterior soft tissues were also drawn very tense. Palpation of the lower end of the femur showed a marked thickening just above the epiphyseal line, and there seemed to be an angular deformity at this point, with the lower fragment bent acutely inward, so that the inferior end of the condyles looked downward and backward nearly to 45 degrees. There was firm bony union between the fragments. The right extremity was an inch and a half shorter than the left. The radiograph apparently corroborated the diagnosis of an oblique fracture from before backward and downward of the lower end of the femur, with backward tilting of the condylar fragment.

On August 1, an incision was made on the external aspect of the femur, just in front of the biceps tendon. This was carried down to the bone just above the joint and the epiphyseal line, and on pushing aside the periosteum no line of fracture could be felt. On passing the finger under the periosteum, however, to the inner side of the bone, the line of fracture, as diagnosed, could be felt, together with the displacement. An attempt to break up the union with the chisel from the wound failed, and accordingly an internal longitudinal incision was made in the line of the adductor tubercle. This was carried down to the bone, and with the mallet and chisel the lower fragment was loosened, and complete separation effected by bending the bone laterally. It was then ascertained that the line of fracture was oblique, from a point about two inches above the epiphysis on the inner side of the femur, outward and downward to the epiphyseal line at the centre of the bone, and thence an epiphyseal



FIG. 2.—Postoperative condition in fracture of the lower end of the femur, with vicious union.

separation from the outer side of the shaft. The lower fragment thus included about two inches of the inner half of the shaft attached to the epiphysis, which had separated from the outer half transversely, and this fragment had tilted backward and united in such a way as to cause considerable shortening and produce the downward and backward aspect of the condyles. This accounted for the symptom of hyperflexion and limited extension, and also explained the absence of a fracture line on the outer aspect of the shaft, the line here being the epiphyseal line, which was below the lower end of the incision. The joint was not opened during the operation. The fragments were brought into very fair apposition by traction on the leg and direct manipulation of the fragments with large bone hooks. The shortening could be entirely done away with, and full extension was possible. The wounds were sutured, with a small kangaroo tendon drain left in the internal one. A plaster-of-Paris splint was applied with the limb in the normal fully extended position, and the fragments forced as nearly as possible into correct apposition. No sutures were used to unite the bone, but the periosteum was carefully sutured. After twelve days a window was opened and the wounds found practically healed. At the end of four weeks the splint was replaced by a posterior one, and in about seven weeks, union seemingly absolutely solid, the patient was permitted to walk. Complete extension was then possible, and there was no shortening. Owing to stiffness in the knee-joint, however, only limited flexion was obtained. It was deemed wise to treat this latter only by walking exercises and massage rather than by any forcible breaking up of adhesions. Now, at the end of about ten weeks, flexion was easily carried beyond 45 degrees, and was increasing rapidly from day to day. Extension was complete and there was no shortening. The functional result promised to be completely satisfactory, though the anatomical result as determined by the radiograph shows still a considerable angularity between the fragments. (Fig. 2.)

AMPUTATION OF SHOULDER-GIRDLE.

Dr. Hartwell presented a man, fifty-five years old, who was admitted to Bellevue Hospital on July 11, 1904. His family history was negative. Twenty-one years ago he fell, striking on his right shoulder and hip, sustaining contusions, but no fracture, and he was incapacitated by the accident for only one week.

Fifteen years ago he first noticed a lump about the size of an English walnut on the top of the right shoulder. For twelve years it grew slowly, but constantly, until it attained a size about four or five inches in diameter. After that it grew more rapidly, and had nearly doubled in size during the past two years. It had never caused him any pain to speak of, and there had been no interference with the movements of the arm. He applied for relief only because the mere size of the tumor interfered with his work, and for the past six months he had been losing weight and strength, which he thought might be the fault of the growth.

The tumor measured about nine inches in its long diameter and four to five inches across, with a height of about five inches above the clavicle. It was firmly attached to the outer half of the clavicle, to the acromion, and for a small distance to the spine of the scapula. It extended from the inner third of the clavicle out beyond the deltoid insertion. On the chest it extended two or three inches below the clavicle, and behind its base passed over the outer portion of the spine of the scapula, just about covering the deltoid border. On this extensive base it was movable to some extent, all the tissues moving with it. In consistency, it resembled the liver, though some portions were harder than others, giving something of a nodular outline to the tumor. There were many large veins passing superficially over it, and the skin was of a bluish tint, and in places thin and just ready to ulcerate. One or two superficial ulcerations already existed. There was a fluctuating, globular mass in the axilla, the size of a small orange, which was movable under the skin and in the deep parts. (Figs. 3 and 4.)

On the inner and posterior aspects of the left thigh, near the gluteal fold, was a second large tumor, several inches in circumference, which in its general appearance resembled a lipoma, but in the centre of which existed a hard, nodular mass, of the nature of fibroid tissue. This tumor he had had ever since he could remember, and he declined to have it removed or a section taken from it. A specimen removed from the shoulder was diagnosed as endothelioma.

Amputation of the shoulder-girdle was done on July 16 of the present year, under nitrous oxide and ether anæsthesia. As a first step, an incision was made over the inner end of the clavicle, this bone exposed, and a two-inch section of it removed with the Gigli saw. This exposed the subclavian vein and the

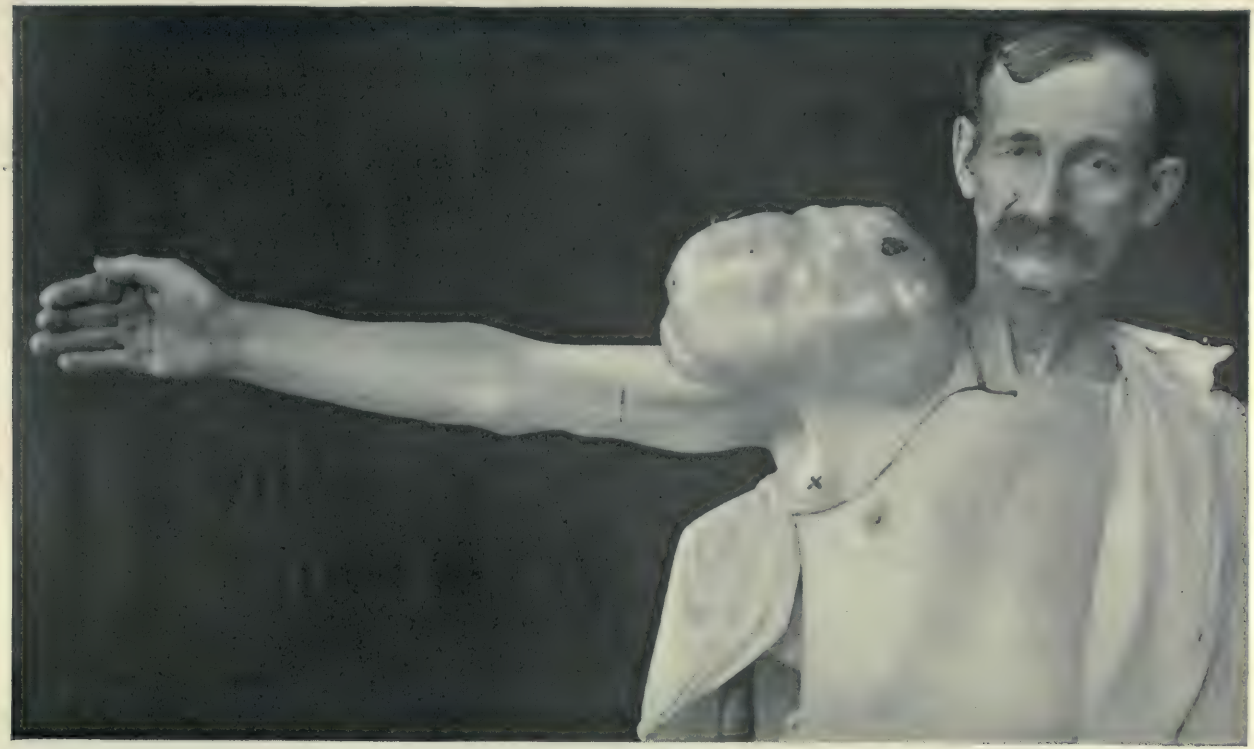


FIG. 3.—Endothelioma of shoulder, anterior view.



FIG. 4.—Endothelioma of shoulder, lateral view.

transversalis coli and suprascapular arteries, all of which were caught in loose ligatures. The scalenus anticus was then divided near its insertion, and the subclavian artery easily reached, doubly ligated with chromic catgut, and divided. The vessels already exposed were then ligated with plain gut, thus limiting as much as possible the amount of blood in the arm. The incision was then carried outward an inch below the anterior border of the tumor and across the axilla below the mass that existed there. The central flap was dissected inward, the pectoral muscles exposed and divided at the level of the skin incision, and the whole axillary contents cleaned out, still attached to the under surface of the tumor. A posterior skin incision was then made, following one inch outside the border of the tumor down into the axilla, below which it joined the anterior incision. The central portion of the posterior flap was dissected inward to the vertebral border of the scapula and downward to the angle. Division of the muscles holding the scapula to the body was then made, the latissimus dorsi was cut through at the level of the scapular angle, and thus the disarticulation in one mass was completed. The early ligation of the vessels so effectually controlled the hæmorrhage that not more than two or three ounces of blood, other than that in the arm, were lost. Five minutes before cutting through the brachial plexus near the outer border of the scalenus anticus, ten or fifteen minims of a 2 per cent. solution of cocaine were injected into the trunks, as suggested by Crile. Though no accurate blood-pressure tests were made, the palpating finger could detect no change in the pulse when the nerve-trunks were divided, and the patient seemed to suffer no shock.

The flaps were easily drawn together without tension, the removal of the deep tissues more than compensating for the loss of skin. A drain was inserted in the lower end of the pocket, through an incision made for that purpose. The condition of the patient was excellent, considering the extent of the operation. Convalescence was uneventful, except for a slight infection in the inner end of the wound, which separated, and finally closed by granulation at the end of several weeks.

Dissection of the tumor showed it invading the clavicle, in the outer end of which there was a hole of about two drachms' capacity, which was filled with the new growth. The periosteum of the clavicle was destroyed in its outer half. The scapula and humerus were not involved.

Pathological report made by Drs. Ewing and Strauss. The structure of the tumor is that of an alveolar endothelioma. The cells are rounded or polygonal in form, of medium size, with homogeneous protoplasm and densely staining compact nuclei. They are arranged in convoluted rows surrounding small alveoli. The alveoli are everywhere embedded in mucus, into which the tumor cells are being transformed. This form of degeneration has probably had much influence in limiting the malignancy of the growth. The tumor masses are rather sharply separated from the surrounding connective tissue, which they show little tendency to invade. The exact histogenesis of the tumor it is impossible to state. In several places the alveoli are distended with blood, suggesting an origin from vascular endothelium, but, on the other hand, most of the alveoli are collapsed and empty. Most tumors of this histological type are derived from the endothelium of lymph vessels. The whole tumor has a markedly embryonal type, suggesting the possibility of origin from a remnant of embryonal tissue. The very definite connection of the tumor with the periosteum of the clavicle suggests an origin from the endothelial structure of this tissue, and such origin has frequently been assigned to tumors of bone showing the same general structure as the present tumor.

SOME EXPERIMENTS WITH A NEW METHOD OF CLOSING WOUNDS OF THE LARGER ARTERIES.

Dr. George E. Brewer read a paper with the above title, for which see page 856.

Dr. Dawbarn said he had done some experimental work along the lines indicated in Dr. Brewer's paper, and his experience had led him to doubt whether it would be practicable to employ an adhesive material in the closure of wounds of the arteries. The surface of the arterial walls was always moist, and a number of years ago, the speaker said, it occurred to him that it would be desirable to find something that would adhere to a moist surface, and that would take the place of a suture in intestinal work. He experimented with a great many substances, even going to the trouble of obtaining a sample of a peculiarly adhesive kind of mistletoe growing in Japan, but all were open to the objection that they would not adhere to a moist surface. Instead of an adhesive substance. like rubber plaster, Dr. Daw-

barn suggested that Cargile membrane might answer the purpose in dealing with wounds of the larger arteries.

Dr. L. W. Hotchkiss said that Dr. Dawbarn had lost sight of the most important feature of the rubber plaster in closing wounds of the larger arteries, namely, its elasticity, by which it exerted compression without constriction. While the possibility of an exudate over a torn surface like an artery should always be kept in view, there was little danger of its becoming troublesome and washing away a compressing agent in the shape of an adhesive and elastic membrane, like the one shown by Dr. Brewer.

Dr. Joseph A. Blake said that while cases in which the method described by Dr. Brewer would be indicated were comparatively rare, they were very urgent when they did occur. The experiments with which Dr. Brewer had been extremely successful opened a wide field for further investigation. The idea seemed perfectly feasible, although the speaker said he did not think it would be applicable to an end-to-end union of the vessels. The plaster might be applied as an additional safeguard in such cases after suture.

Dr. Lilienthal said he saw Dr. Brewer resort to this method in an experimental operation on a dog last spring, and he was struck by the great difficulties he had to contend with. The speaker said he would be willing to give the method a trial in case he ever had the misfortune to wound a large artery, but not without employing sutures as well. If the rubber plaster acted so well without suture, then it certainly ought to be a very valuable adjunct to imperfect suturing, and in such a case might even prove a life-saving measure. While wounding a large artery was a rare accident, it was likely to happen to anybody.

Dr. Brewer, in reply to Dr. Dawbarn, said he thought that rubber plaster was preferable to Cargile membrane because the former maintained the normal elasticity of the artery. In regard to the use of sutures, Dr. Brewer said it was a difficult matter to suture an artery of small caliber, or one that was the seat of calcareous degeneration, or when high arterial tension was present, and under such circumstances the speaker said he would not hesitate to use plaster alone; and he would be inclined to do so in dealing with any artery that could be exposed and reached. In certain cases, of course, where the artery could not be elevated or surrounded, the method would be inapplicable.

EDITORIAL ARTICLE.

THE ANNALS OF SURGERY, 1885–1904.

THE present issue of the ANNALS OF SURGERY completes the first twenty years of its publication. Its file presents now forty substantial volumes, through all of which, from No. I to No. XL, has worked the same editorial supervision, while the ideal of excellence both as to the scientific character of its contents and their typographical presentation, with which the Journal was inaugurated, has been continuously maintained.

Very singularly during all this time the ANNALS OF SURGERY has practically had the field to itself as far as journals in the English tongue were concerned; it is true that the general weeklies and monthlies have continued to publish many articles of a surgical nature that were of value and interest, and that other journals devoted to some aspects of surgery have from time to time appeared; gynæcological surgery, orthopædic surgery, and minor surgery and surgical technique have thus had organs, but in the wider domain of General Surgical Science and Practice in which the plans for the ANNALS OF SURGERY placed it, it has been permitted to pursue its own development without a rival. In other countries the production of a special surgical periodical literature has been much more marked during the same period. The special surgical journals of Germany, France, Russia, and Italy have become numerous and important. Their papers are of the highest value, and the work which they record may well stimulate the earnest emulation of surgeons everywhere.

The inauguration of the publication of the ANNALS OF SURGERY as a "Monthly Review of Surgical Science and Practice," as its title-page proclaimed, was due to the enterprise of a Western book publisher, Mr. James H. Chambers, of St. Louis, Missouri.

Interest always attaches to the beginning of things, if in their later development it has appeared that the things begun were of any importance, so, in view of the twenty years of history which this "Monthly Review" has since made and its increasing acceptance as a valued exponent of current surgical doctrine and effort, it may not be out of place to now record the circumstances attending its beginnings.

During the year 1883, the Anatomical and Surgical Society of Brooklyn, New York, had carried on the publication of a monthly periodical, with the title, *Annals of the Anatomical and Surgical Society*, in which addresses, papers, and discussions constituting the transactions of that Society were published. At the end of that year, this publication was continued; no longer, however, as a bulletin of the work of that particular Society, but upon more general lines, under the title of *Annals of Anatomy and Surgery*, under the proprietorship of Drs. Lewis S. Pilcher and George R. Fowler, who were also its editors. With much success and acceptability this journal continued to appear for three years. This was made possible, first, by the considerable interest which many surgeons in all parts of the United States were brought to take in the publication, and, second, by the familiarity with typographical affairs and efficiency as a business manager of Dr. James E. Pilcher, to whom the duties and responsibilities of publishing the magazine were referred. With the end of the year 1883, however, it appeared that it would be no longer possible to continue the further publication of the journal. Dr. James Pilcher had been commissioned as a medical officer in the United States Army, and had been sent to a distant post in the Northwest; Dr. Lewis Pilcher was sailing for Europe for a somewhat prolonged absence, and Dr. Fowler was burdened with other work which had to take precedence of editorial and publishing duties. Accordingly with the publication of the issue for January, 1884, the *Annals of Anatomy and Surgery* were suspended, without any thought upon the part of any of those who had been promoting its

publication of engaging in any similar work in the future. In London, however, during the following spring, during an after-dinner talk between Dr. Pilcher and the well-known senior surgeon of the West London Hospital, Mr. Charles B. Keetley, the history of the *Annals of Anatomy and Surgery* was recited, and Mr. Keetley expressed the hope that at some time a more strictly surgical journal which should represent all English-speaking surgeons might be established, adding that he would gladly co-operate in such an enterprise. Without any plans or serious expectations along this line, Dr. Pilcher returned to New York the last of May, 1884. Awaiting his arrival in New York he found Mr. Chambers with a proposition for the establishment of a strictly surgical journal of the highest grade. That gentleman stated that he was satisfied there was a field for such a journal, that especially at the suggestion of Dr. Nicholas Senn and of Dr. Roswell Park, with whom he had consulted upon the matter, he was desirous of securing the co-operation of Dr. Pilcher in the editorial direction, and that he was willing to place in the hands of such editor the absolute control of the contents of such journal and a censorship over the advertising pages as well. During the ensuing summer further correspondence ended in the making of an agreement between Mr. Chambers and Dr. Pilcher on the lines of this first interview; the co-operation of Mr. Keetley, as a representative English surgeon, was unhesitatingly given when the proposition of the St. Louis publisher was communicated to him; a large number of the leaders in surgery in the United States and Great Britain were informed of the proposed publication, and without exception gave the enterprise their approval, and permitted the use of their names as endorsing it upon the title-page of the new journal; at the head of this list was the name of Lord Lister.

The first number of the new journal appeared January 1, 1885, and in regular succession it has continued to appear from that time to the present upon the first of each month. During the

earlier years abstracts and digests of the surgical literature of other lands formed a very important part of the contents of each number of the journal, but more recently, notwithstanding the increase in the number of pages of the journal to nearly twice their original number, the number of original contributions of value continually being offered for publication has become so great as to reduce to insignificance the abstract or "Index of Progress" department. This the Editor has seen occur with a distinct sense of loss on his part, for he had from the first felt that to bring first hand to the knowledge of English-speaking surgeons so much of the results of the work of able men published in other tongues was a function of no mean importance. During the seven years, 1885 to 1891 inclusive, the ANNALS OF SURGERY continued to be published at St. Louis by Mr. Chambers. It is probable, however, that the more sanguine and earlier expectations of the publisher as to the journal as a profitable business investment were slow in being realized. In the first place, such a journal was an expensive thing to publish, and the ideals of its editors prevented the introduction into it of a grade of surgical literature that might have made it appeal more strongly to the interest of large classes of medical men, while the location of its publication office in the West might possibly be considered as having a deterrent effect upon the extension of its subscription list among those to whom it expected to appeal for patronage, since a large proportion of these were to be found in the East. For this reason Mr. Chambers, after a number of years, offered the journal to Eastern publishers, and finally disposed of it to the University of Pennsylvania Press, by whom its publication was undertaken, beginning with January, 1892, and continued until June, 1897, when, upon the reorganization of that Association, the ANNALS OF SURGERY was transferred to the J. B. Lippincott Company, its present publishers. This then is the history of the origin of the ANNALS OF SURGERY. The forty volumes which now constitute its file show how well the editors have been able to carry out their

ideals, when it was inaugurated, that it should fully represent the highest attainments of current Surgical Science and Practice. They have been greatly helped in their endeavor by the fact that they were themselves active workers in the surgical field and were always in touch with their fellow-workers, whose needs and ideals they shared and kept in view in the shaping of each succeeding issue. While the chief burden of journalistic work has from the first been borne by Dr. Pilcher, nevertheless the assistance rendered by his collaborators has been frequent and most valuable. In Mr. Keetley, Mr. Treves, Mr. Jacobson and Mr. Cheyne, Dr. Macewen and Dr. White, the ANNALS has ever found wise counsellors, interested collaborators, and valuable contributors.

While the ANNALS may be said to have been a mirror of contemporaneous surgery, it may be claimed that it has been something more than a mirror to passively reflect what was brought before it. Surely it has exerted a very active influence in moulding surgical thought and directing surgical endeavor as each month it has brought to thousands of active surgeons the record of the methods, achievements, and theories of many of their fellows. In the selection of that which it should present, its influence has always been on the side of reason, of practicability, and of sanity.

The past twenty years has witnessed a wide diffusion of trained surgical knowledge and experience. No longer is special skill limited to a few men in great centres, but everywhere, in State and town and colony, are to be found men of thorough training, of hospital experience, skilled in aseptic technique, with knowledge of pathology and diagnosis and practice, who have arrived on the professional scene since the ANNALS OF SURGERY began to do its work. It is into the hands of these men, products and exponents of the new surgery, that the surgical work of the world has either already or will soon come. To record their achievements during the coming twenty years will be a task equally calculated to elicit an editor's enthusiasm as have the conditions of 1885 to 1904.

REVIEWS OF BOOKS.

A Manual of Operative Surgery. By Sir Frederick Treves, Bart. New Edition, revised by the Author and Jonathan Hutchinson, Jr. In two volumes, 8vo. Philadelphia and New York: Lea Brothers & Co., 1903.

This book, upon its first publication, was reviewed at length in the Annals of Surgery of March, 1892. The expression of favor which was awarded it by the reviewer of that date has been justified by the popularity with which the profession in general has continued to regard it ever since, notwithstanding the conspicuous merit of other works, occupying the same field, which have also appeared since its publication. After a lapse of twelve years, one is naturally anxious to see what changes its author has felt himself compelled to make in his effort to keep pace with current progress. The periodical literature of these years has been full of novel operative suggestions, and the very great widening of the scope of operative effort which has also marked these years must have taught many lessons that had not yet been learned in 1892; so we turn to this new edition with the expectation of finding in it the matured judgment of the recognized present leader of English surgery upon the operative problems that have occupied the surgical mind during the past twelve years. This expectation requires but little, if any, modification when we read that the main part of the work of revision has been carried out by Mr. Hutchinson; for, although the executive hand has been that of the junior surgeon, we may still assume that the responsible directing head has been that of the senior. Evidence of one of the most characteristic changes in the operative surgery of the period appears as a prelude even to the title-page itself in the large frontispiece, bearing the legend, "A

Modern Operating Theatre ready for Use," which is a picture of one of the operating theatres of the London Hospital. Mr. Treves, in his first edition (Chapter III), said, " Of the operating theatres and operating wards of hospitals it is not necessary to speak." In the new edition, however, several pages of text are devoted to a description of the operating theatre depicted in the frontispiece, to which are added many other cuts showing details of arrangements and apparatus. The change, of which we accept this as one of the evidences, is the increasing tendency of all important operative surgical work to seek hospital conditions for its performance, *pari passu* with which have gone the efforts of hospital authorities to perfect the surroundings in which this work is to be done. Another change in the beginning of the book attracts our attention, and makes a pleasant impression. It is the elision of the words " scrofula" and " scrofulous" and " strumous" from the book, and the substitution therefor of the words " tuberculosis" and " tuberculous."

In the first edition, mention of the " steam spray" could not be omitted. It had to be discussed even if only for an explanation of the reasons for abandoning its use. In this new edition it is not even mentioned. The chapters on anæsthetics have been omitted altogether. It gave something of a wrench to our preconceived notions of what might be considered as an important operative preliminary not to find any mention of it in the work; neither ether, chloroform, nor anæsthesia are to be found in the index; but neither also do we find any mention of shock as a postoperative condition, nor of the operation of intravenous saline infusion to combat it. Evidently the authors have not considered these subjects as coming within the scope of their work; it would seem, however, that they ought to have a place in a reasonably complete manual of operative surgery.

The chapters on ligation of arteries remain without material change. That department of surgery has not grown as much as some others during the past decennium.

In some of the illustrations of amputations and excisions, the surgeon's cuffs and coat-sleeves, introduced in preantiseptic days, are still in evidence, having escaped the attention of the reviser (pp. 271, 424, 462, 467, 584, 617, 618, 665), copies from Farabœuf.

In the chapters devoted to abdominal operations and to hernia we find the greatest changes; not that any more space is devoted to these subjects in these volumes than formerly, but the substance of the chapters is quite rewritten. Much of that which was on trial fifteen years ago has been definitely accepted, or rejected, or replaced by something better since, so that the present writing well represents the opinion and practice of the best surgeons of to-day. Fewer different methods are described; more attention is given to the principles that should guide the surgeon, and more frequently a definite judgment is rendered as to what in the opinion of the writer is *the* method of procedure.

A much fuller consideration of the surgery of the appendix vermiformis is given than in the former edition, as is natural, considering the increased importance in the surgical world which has become attached to that anatomical member.

The chapter on excision of the breast in carcinoma has been rewritten. This well illustrates the change in surgical practice that has taken place, and the readiness of the writers to change their opinions and practice. In 1892, the writer said, "The heroic evacuation of the axilla which involves the laying bare of the whole of the axillary vein, the removal of the fatty tissue of the entire space, and the exposure of the upper ribs, has nothing to recommend it." In the preceding paragraph it had been said, "the glands may be most conveniently removed with the fingers"! We detect in this phraseology a lack of sympathy with the teaching, then beginning to come into vogue, that the utmost thoroughness in the systematic removal of possible minute foci of infection in the axilla should be a part of every operation for carcinoma of the breast. But in the present edition this dictum

is accepted in no uncertain terms. After a very just and full statement of the very general axillary gland infection that attends carcinoma of the breast, it is said that "excision of a cancerous breast should always include excision of the axillary lymphatic glands." No slighting allusions now to "heroic" evacuations of the axilla, but an added statement that "if the supraclavicular glands are suspected they also should be removed."

It is not necessary to multiply further examples of the admirable manner in which this revised edition has been made to reflect the most approved work of to-day. The work is more than a hand-book; it is in two sizable volumes; there is much of history and criticism in it, and it will be sure to command the interest and confidence of surgeons for a long time.

LEWIS S. PILCHER.

A MANUAL OF SURGICAL DIAGNOSIS. By JAMES BERRY, B.S., F.R.C.S., Surgeon to and Lecturer on Surgery at The Royal Free Hospital; formerly Surgical Registrar and Demonstrator of Anatomy, of Operative Surgery and of Practical Surgery at St. Bartholomew's Hospital. Philadelphia: P. Blakiston's Son & Co., 1904.

This compendious book offers its readers eminently practical information of the whys and wherefores essential to making a surgical diagnosis.

The subject-matter is treated of in three parts. The first part is devoted to a consideration of the general principles underlying surgical diagnosis. It opens up with remarks bearing on the taking of a history, and the various modes of physical examination accessory towards establishing the diagnosis.

In the third part attention is directed to the diagnosis of the diseases of the various organs. A few chapters are devoted to the differential diagnosis of a particular symptom-complex, as, "Inability to Open the Mouth, Dysphagia, Abdominal Swelling, Intestinal Obstruction, Pyuria and Hæmaturia, and Aneurism."

The third part is descriptive of the diagnoses of injuries of the body regionally considered.

The commonplace affections, and not the exceptional, are admirably narrated; and, though no concrete examples are presented to further the understanding of making a surgical diagnosis, yet the story is in each instance so tersely and clearly told that the reading of this book at no time becomes a drudgery.

The salient factors in the development of the diagnosis are printed heavily, and this feature, together with the extensive index alphabetically arranged, facilitates reference. Furthermore, the small size of the volume makes it convenient to have about.

This book fills a gap in the literature of surgical text-books. It is not placing our estimate of this valuable book too high to urge its perusal upon every student of medicine who would qualify himself in the art of surgical diagnosis.

MARTIN W. WARE.

CHIRURGIE ORTHOPÉDIQUE. Par Le Professeur PAUL BERGER et Le Docteur S. BANZET, Chef du laboratoire de Médecine operatoire à la Faculté de Médecine de Paris. Avec 489 figures dans le texte. Paris: G. Steinheil, Editeur, 2, Rue Casimir-Delavigne, 1904.

The joint authorship has resulted in giving us a very voluminous book replete in all that appertains to orthopædic surgery.

The authors take a conservative stand in the advantages accruing from the application of the knife in orthopædics, and they warmly indorse mechanotherapy.

The subject is considered in three parts,—that of the trunk and the extremities,—and each part is divided into articles, these in turn being treated of in various chapters.

The type is of very large size and printed on heavy paper, widely marginated. The text covers 593 pages, and there are 483 illustrations.

The teachings represent the best accepted methods the world over; but the reader, however, will search in vain for anything novel.

The most recent conquests in the branch of orthopædics—tendoplasty for paralytic affections and coxa vara—are thoroughly handled. The latter is very well elucidated by numerous splendidly executed half-page drawings. The same comment holds good for the chapters on cicatricial contractures.

In connection with the operative procedures for the cure of congenital dislocation of the hip, we have encountered in the perusal of these pages the little recognized method of Broca, who, through an oblique incision traversing the thigh, performs a resection of the great trochanter, thereby widely exposing the head in its misplaced position.

A carefully arranged index and a list of illustrations complete this work.

MARTIN W. WARE.

THE PRINCIPLES AND PRACTICE OF GYNÆCOLOGY. By E. C. DUDLEY, A.M., M.D. Fourth Edition, Revised. Philadelphia and New York: Lea Brothers & Co., 1904.

During the twenty years which have elapsed since the establishment of the ANNALS OF SURGERY, the progress of our art in all its branches has been greater than that of centuries previous. Bacteriology was then in its infancy, and the technique, for which we are indebted to Lord Lister, was in process of evolution and struggling for recognition. In gynæcology, the history of the cycle has been the history of modern abdominal surgery. This has been made a possibility, however, by the discoveries of the bacteriologist and their application to the practical problems of the surgeon's art. Thus the birth and growth of a new science opened up new fields of achievement to the surgeon. The literature of a science may fairly be said to mark its progress. So, if we glance over the pages of the standard works on Diseases of Women

published a generation ago and compare them with this the newest work on the subject, we shall appreciate how vast have been the advances in our art since the great Kentuckian, McDowell, blazed a way through the difficulties which up to his day surgeons had considered an *impassè*. Our plastic surgery differs but little, if at all, from that taught us by the fathers and pioneers of surgery, Syms and Emmet. We have not improved on their methods. The illustration of the text-books of to-day on this subject are far clearer and more illuminating than the crude drawings which obscured the pages of the books of those days, but the principles of the operations are essentially the same. If changes have been made, it is in the matter of minor details, such as suture materials and instruments.

The plastic operations of these old masters have stood the test of twenty years. Twenty years hence not a few operations now fashionable will have been abandoned. Far different, however, are the bold and scientific methods by which we attack the inflammations or those conditions which require the resources of the modern abdominal surgeon. It is interesting to compare the hesitating tentative methods of the older school of gynæcologists in respect to the treatment of pelvic inflammations with that in vogue to-day. A quotation from the *Transactions of the Medical Association of the State of Missouri* will serve to illustrate. "About a year ago I was called to see Mrs. V., and found her suffering with a pelvic abscess, *from which she soon got relief by its discharging through the bladder.*" What practitioner would care to make such a statement before a body of medical men, or to acknowledge that he had permitted a pelvic abscess to take care of itself? In one of the standard works published in 1883, all inflammatory affections of the pelvis are classed under the head of pelvic cellulitis. The word pyosalpinx does not occur in the book. Removal of the infected tubes is nowhere even suggested, and not a word is said as to the relation between gonorrhœa and inflammations of the pelvic viscera. Nor ought we to

wonder at this, for it was not until 1885 that Bumm first demonstrated conclusively the pathological rôle played by the organism discovered six years previous by Neisser.

The surgery of the inflammations was of the simplest, and the master of those days rested content if he evacuated the abscess, which he had allowed to point, with the aspirator or a hesitating knife or scissors' blade. Cataplasms, injections, iodide of potassium, tincture of iodine, these were the weapons of the old school. When the pus became so evident that fluctuation could be felt through the thinning vaginal wall, a timid operation was done, unless, indeed, nature had not first anticipated the physician and done a crude operation such as the Missouri doctor relates in the quotation above.

The chapter on pelvic inflammations in the work under review emphasizes the distance between the gynæcologist of to-day and his forbears of a past generation. A correct classification, not only according to the seat of the lesion but its bacteriological relationship, has replaced the crude methods of those times, and our methods of treatment have correspondingly improved. It seems strange, in glancing over the text-book of twenty years ago, to find that the only mention made of so important a subject as ectopic gestation is to warn the observer against mistaking it for a cystic tumor of the ovary. We used to hear a good deal about pelvic hæmatocele in those days, both at the clinics and in the didactic lectures on gynæcology. If by chance an ectopic pregnancy was recognized previous to rupture, we were told to use strong currents of electricity to destroy the life of the ovum. We may certainly congratulate ourselves on the advances which surgery has made in the treatment of this the most fatal accident that can occur to an expectant mother. We observe, in comparing the old gynæcology with the new, similar and great differences between the operative treatment of the myomata from that with which we were familiar in our student days. What medical student of to-day has ever even heard of the clay electrodes of Apostoli, much less seen them? We have a number of different

operations for the removal of uterine myomata, all of them with a low death-rate in experienced hands. In the management of the pedicle of the ovarian cyst, the clamps of Spencer Wells and others, designed to secure the stump outside the abdomen, are now consigned to the hospital museum, and the inquiring house staff not seldom come to us and ask us what those things were used for. The operating case of every large hospital has a hundred pounds more or less of such discarded hardware. One might write an interesting and perhaps humorous article on the passing of the pessary. The older works have whole chapters devoted to a description of the various pessaries, and some of the illustrations cause us to wonder at the patience with which the vagina has tolerated all sorts and shapes of foreign bodies designed to sustain a displaced uterus. One in particular, illustrated in an old work, resembles a Chinese puzzle as much as anything else. Emmet tells a story in his work about a man who wished his endorsement for a new pessary; whereupon Emmet showed him a closet which contained between five and six hundred pessaries which he had used on different cases, and promised his endorsement if the petitioner would find any two exactly alike. The man spent the afternoon on the job and gave it up. When we come to sum up the results of the best modern work for the relief of carcinoma of the pelvic organs and compare it with the surgery of malignant disease as it was twenty years ago, we cannot but feel the most intense chagrin. Not that we have not taken every advantage of our improved technique. What have we not done to save from death the sufferer from carcinoma of the cervix? Surgeons have cleaned out the entire pelvis with the exception of the great blood-vessels and the ureters, and still their patients have died of carcinoma. The results of Byrne's cautery operation still challenge modern methods. It has been fashionable to say that the cases which he reported were not cases of cancer, but Byrne was too good a clinician not to know malignant disease when he saw it. The microscope is not always necessary in the diagnosis of carcinoma. We can only hope that at the end of

another twenty years those who are to come after us will have a better record to show in the surgery of malignant disease than is possible to any of the surgeons of the present day. As we peruse the pages of this book, however, we find sufficient reason to congratulate ourselves that while the mystery of the most dreadful scourge of womanhood remains still unsolved, yet our art has made great advances. If there are dark recesses still to be explored, floods of light have been cast upon many phases of disease that were as dark to our fathers as cancer is to us.

ALGERNON T. BRISTOW.

GENITO-URINARY AND VENEREAL DISEASES AND SYPHILIS. A Treatise by ROBERT W. TAYLOR, A.M., M.D., Clinical Professor of Genito-Urinary Diseases in the College of Physicians and Surgeons, New York. Third Edition. Octavo, 757 pages. Philadelphia and New York: Lea Brothers & Co., 1904.

This volume treats of Venereal Diseases, Genito-Urinary Surgery, and Syphilis. In the department of Venereal Diseases it is much stronger than in Genito-Urinary Surgery.

Most authorities will take issue with him in regard to the length of time that the gonococci remain in the tissues. It is generally conceded that the germ remains for almost an indefinite period in the tissues, and that is the reason the mucous membrane continues in a diseased condition.

His unqualified condemnation of the use of the albuminates of silver in the treatment of acute gonorrhœa is not borne out in the experience of the vast majority of clinicians.

In the part devoted to the surgery of hypertrophied prostate, the author mentions only the suprapubic method of enucleation, and no mention is made of the different operations by the perineal route, now almost universally employed.

In the discussion of Syphilis, the author is at his best. He is clear, concise, and able. The value of this one subject alone would be sufficient inducement to purchase the book.

HOMER E. FRASER.

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